Toward Improved Transit Station Access in Pedestrian-Unfriendly Environments

by

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Submitted to the Department of Civil and Environmental Engineering
in Partial Fulfillment of the Requirements for the Degree of
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ABSTRACT

The resurgence of rail transit in the United States has introduced transit stations into environments of dispersed development oriented primarily to automobile travel. In addition, alignments for new transit lines have frequently been chosen in highway and railroad corridors where walking conditions are poor. Park-and-ride lots and feeder bus routes have facilitated access to stations in these compromised locations, while pedestrian access has often been neglected.

This research examines the untapped potential of increased ridership and expanded ridership markets that can be realized through improved pedestrian access to transit stations. It finds that wider benefits to society, including reduced air pollution, increased development potential, enhanced equity, individual health benefits, and an improved quality of life can be realized through more walkable station area environments.

Case studies of stations representing urban, inner suburban "greyfield", and outer suburban "greenfield" environments are undertaken to evaluate both the various impediments to pedestrian access found at different station areas, as well as to identify strategies for facilitating pedestrian access to stations in a range of contexts.

The examination of specific stations is augmented by a review of previous research on pedestrian behavior and travel to arrive at specific guidelines for improving pedestrian access. Walking to stations is encouraged by: a dense network of direct and continuous routes to stations; convenient and safe opportunities for crossing streets; a perception of safety and security prevailing along pedestrian routes; the provision of information and station identification; and a level of urban vitality marked by pedestrian activity, pedestrian-oriented uses, and pedestrian-scaled design.

The guidelines are applied to both an existing rapid transit system currently undergoing renovations as well as to an entirely new one now under construction: the elevated and subway lines of Chicago, Illinois, and Tren Urbano in metropolitan San Juan, Puerto Rico. Recommendations for specific interventions to improve pedestrian access to four Chicago Transit Authority rapid transit stations and two future Tren Urbano station sites, along with suggested implementation frameworks, are advanced.

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DEDICATION AND ACKNOWLEDGEMENTS

This thesis is dedicated to my late grandfather, Sherman L. Park, who withdrew from his study of engineering at the University of Utah in the years of the Great Depression due to the financial hardship imposed by a prolonged illness suffered by his mother. When I was about seven years old, Grandpa Park took me on the first transit trip I can remember, a ride on the #14 East Millcreek bus. A couple of years later, it was me taking him and Grandma home from the Checkpoint Charlie Museum in the shadow of the Berlin Wall on three *U-Bahn* lines and a double-decker bus. Grandpa didn't live to see me pursue the engineering studies that he was unable to complete or attend graduate school in his mission field of New England, but may he be pleased with the time I have spent here and with this accomplishment.

This work is as much the work of my thesis advisor, Ken Kruckemeyer, as it is mine, and I wish to thank him for his patience and gracious assistance during the past two years. It has been a privilege to research this topic with someone who has spent so much of his career considering pedestrian travel. I am indebted to Ben Hamilton-Baillie for reading through my many drafts and for sharing his witty British perspective. May all of our efforts to facilitate walking, biking, and transit be met with success!

Many thanks to the faculty involved with the Tren Urbano technology transfer and, more recently, the CTA joint research collaboration, particularly: Nigel Wilson, Fred Salvucci, and Mike Shiffer. I have been fortunate to have taken courses from each of you and have gained from each of your different perspectives on transportation.

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A special thanks to Gene and Connie Ransom in my "hometown" Aurora for their hospitality, allowing me to attend Rail-Volution in Denver and research the new Southwest light rail line; and to Steele Knudson and his family, for providing me a place to stay, a cell phone, and a vehicle (to drive to the park-and-ride, of course!) while I studied the Metro around D.C. Our visits to and critiques of transit in Salt Lake, Denver, Portland, Seattle, Boston, and Washington are the basis of this research. One of these days we will get someone to film our documentary of riding transit around the country!

Finally, thanks to my sisters and brothers, Candice, Brandon, Charlton, Rachele and Darci for humoring me on uncounted adventures on transit; and my deepest gratitude to my parents, Birgid and Gordon Park, for their support during all of these years of school and for encouraging me to accept the great opportunity to study at MIT. Thanks, Mom, for your hundreds of letters, postcards, and email messages that have followed me wherever my studies have taken me. Thanks, Dad, for accepting and supporting my decision not to study the human anatomy as you did and practice medicine as you have, but to study urban structures and systems and devote my career to improving the health of cities.

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INTRODUCTION

1.1 Pedestrians and Transit

Recent years have witnessed a renaissance of urban rail transit throughout the world. Once cast off as an inflexible, outdated anachronism, rail is now widely seen as part of the antidote to the traffic congestion that grips many cities. Streetcar and metro lines built before the advent of the automobile depended on passengers walking to the stations for their viability. Lines were built where people lived and worked—and where they were extended, development clamored to be within walking distance of the stations.

Older rail systems that survived abandonment continue to enjoy a proximity to a large number of origins and destinations that riders can reach on foot. This, however, is often not the case with the dozens of new rail lines that have been built in recent decades. From the 1920s on, the growth and popularity of automobile travel has brought attention away from the pedestrian realm and focused it instead on designing streets and neighborhoods for cars. Where new transit lines are built, they are often introduced into environments that discourage walking.

While stations in pedestrian-unfriendly environments are not unique to the United States, their predominance in this country poses significant challenges to transit's ability to achieve its intended goals of mitigating congestion and improving air quality. In other nations, new development has not been quite so dispersed, rates of automobile travel have not been as high, and pedestrian and bicycle travel has retained some importance. Consequently, transit attracts a greater share of trips almost everywhere else in the world. However, as G.B. Arrington notes, "we frequently look to Europe for inspiration on how to make public transit work in America. In fact, Europeans use transit only a bit more than Americans. What they do a lot more of every day is walk."[1] A greater incidence of

[1] Arrington 2000, 59

pedestrian-friendly environments around stations in Europe and elsewhere allow many more trips to be accomplished on foot for comparable numbers of transit trips.
This synergistic relationship between walkable environments and transit viability has often been neglected in the planning of many of America's modern transit lines. Instead, access to stations is intended to occur by motorized modes—the automobile and feeder bus networks. This model does not fully realize transit's potential and has produced lackluster results. To be sure, many new riders are attracted to transit through rail investments, but congestion and pollution remain. Transfers are unattractive to riders and providing enough parking to meet demand remains an elusive goal for many transit operators.

Encouraging walking to stations is a daunting challenge, requiring a focus on details and cooperation between multiple jurisdictions. This thesis seeks to identify how improving pedestrian access to stations has been and can be done, while setting forth the benefits that increased walk-up access has on transit's success and viability. Case studies explore both the inherent constraints to pedestrian access found at many stations, as well as interventions that have been undertaken to mitigate them. The literature on pedestrian behavior in general is analyzed, and then related to the specific case of walking to transit stations. The findings are then applied to two contemporary transit projects: the construction of an entirely new system in metropolitan San Juan, Puerto Rico, and the ongoing rehabilitation of the rapid transit lines of Chicago, Illinois.

1.2 Constraints on Pedestrian Access

In this section, a brief history of rail transit sets the stage for an explanation of why the locations of so many transit stations are dysfunctional for pedestrians. A prototypical station ideally situated for pedestrian access is described as well as one where this access is compromised. The underlying reasons why this may be the case is then illustrated through examples of actual stations in U.S. cities.

1.2.1 The Evolution of Rail Transit in the United States

Street railways, elevated railroads and subways appeared in America in the late 1800s and radically changed urban living. Cities once confined to small, walkable areas were suddenly able to expand at rates never before seen. Most mid-size cities had at least one trolley line, and many boasted extensive networks. These disappeared toward the end of the first half of the twentieth century, as investments and policies favored the private automobile.

Cars came to symbolize American freedoms and allowed a flexibility and convenience that rail transit had not provided. Reliance on the automobile, however, raised increasing concerns. In the 1960s, opposition to urban freeways and other modifications that were being made to accommodate automobiles grew. In the 1970s, oil embargoes made Americans aware of the greater political and economic implications of their transportation choices. In the meantime, where rail transit survived, it suffered from serious disinvestment and dysfunction. However, its promise as an alternative to the pollution and congestion of automobile-dominated urban areas was reconsidered, and new rapid transit systems and extensions were planned in the 1960s.

Those first modern rapid transit systems, including San Francisco's Bay Area Rapid Transit (BART) and Washington's Metrorail, began operations in the 1970s and have now seen a generation of service. Those two urban areas are now unthinkable without their rail systems, and have demonstrated that rail transit technology has not outlived its usefulness. Following their lead, the last quarter century has witnessed a resurgence of rail transit in cities across the United States. New lines and extensions open each year, and transit ridership has reached its highest level since 1959.[2]

[2] Salant 2001

1.2.2 Contemporary Transit System Planning

A century ago, the nation's first rail transit lines relied heavily on pedestrian access. Walking was, after all, the predominant mode of transportation. As communities have been retrofitted and designed to accommodate automobiles—often to the exclusion of pedestrians—walking to transit, along with walking in general, has lost its position as a dominant mode. In planning for motorized access with park-and-ride lots, "kiss-and-ride" drop-off lanes, and bus transfer facilities, the needs of pedestrians are often forgotten.

As light rail lines, the modern version of the streetcar, and new rapid transit systems have been conceived, planners and engineers are often faced with two conditions working against a successful transit system:

- First, many lines must be retrofitted into environments that are not oriented to transit, but rather toward automobiles. This makes it inherently difficult to adequately serve all of the dispersed origins and destinations. The answer to this problem has been to serve the largest trip generator—typically the traditional downtown—with outlying park-and-ride stations designed to intercept automobiles and feeder buses.

- Secondly, the expense and difficulty of introducing a rail line in already built-up areas often leads to the choice of highway or railroad corridors for alignments. They offer available right-of-way, but typically little transit-supportive uses, especially residential development. Park-and-ride lots fit easily into these automobile-oriented environments, and the pattern is reinforced: rail transit is mainly for serving park-and-rides and bus transfer stations, and secondarily for serving *neighborhoods* and actual *destinations.* Pedestrian access to stations is often either not intended or facilitated.

Figure 1.1 ***Pittsburg/Bay Point BART Station***
Pittsburg, California

Figure 1.2 ***Buckhead MARTA Station***
Atlanta, Georgia

Many of the newest rail transit stations in the United States are built in highway medians

While this model has been widely accepted, it represents a failure to tackle the more difficult issues that lie at the root of the problems of congestion and pollution that rail transit promises to alleviate. Furthermore, it disregards areas of great potential for rail transit, including its ability to attract significant increases in transit ridership and its power as a tool for focusing development. For various reasons, stations are located in pedestrian-unfriendly environments. Walking to origins and destinations from the transit station is either compromised by distance—as in areas of dispersed, auto-oriented development—or by obstacles, such as a highway or railroad sharing the same corridor as the transit line.[3]

In recent years, the concept of "transit-oriented development" (TOD) has gained ground as a way of increasing transit's effectiveness by adding to the functionality of stations beyond park-and-ride lots and bus transfer points. By introducing a pedestrian-friendly environment, TOD addresses many of the issues faced by compromised stations—but not all. Very often, it is not so much new development, but simply better connections to existing development that are needed to facilitate pedestrian access. Ways of accomplishing this are the focus of this thesis.

1.2.3 Transit Station Siting

This section illustrates prototypical examples of station areas "optimal" and "compromised" with respect to pedestrian access. Examples from various U.S. transit systems describe the many compromises that lead to the siting of stations in pedestrian-unfriendly environments.

Optimal Station Siting

The ideal location for a rail transit station is at the heart of a walkable, pedestrian-friendly environment. These are most often found in traditional downtowns and other urban areas built prior to the advent of the automobile. They provide an interconnected network of streets and therefore many routes for pedestrians, and their dense development offers many origins and destinations within walking distance (see Figure 1.3). Planners and researchers have arrived at a number of different "rules of thumb" for the distances people are willing to walk. In his prototype of a carfree city, J.H. Crawford proposes districts of 380 m (1,200 ft) radius so that all points are within a five-minute walk of a central transit station.[4] Noted New Urbanist Elizabeth Plater-Zyberk suggests an "ideal neighborhood size" of 400 m (one-quarter mile) from center to edge.[5] TOD-pioneer Peter Calthorpe proposes 600 m (2,000 ft) as the distance of a comfortable ten-minute walk "for the majority of people."[6] Research suggests that transit patrons will walk greater distances to reach light rail or rapid transit stations (500-800 m/one-third to half a mile) than to reach bus stops (400 m/one-quarter mile).[7] Based on these recommendations, the "station area" in this research is thought of as being the area within 500 m (one-third mile) of a transit station.

[4] Crawford 2000, 147
Crawford bases his calculations on a walking speed of 76 m/min (250 ft/min)
[5] Plater-Zyberk 2000, 81
[6] Calthorpe 1993, 56
[7] Lieberman 2000, 102

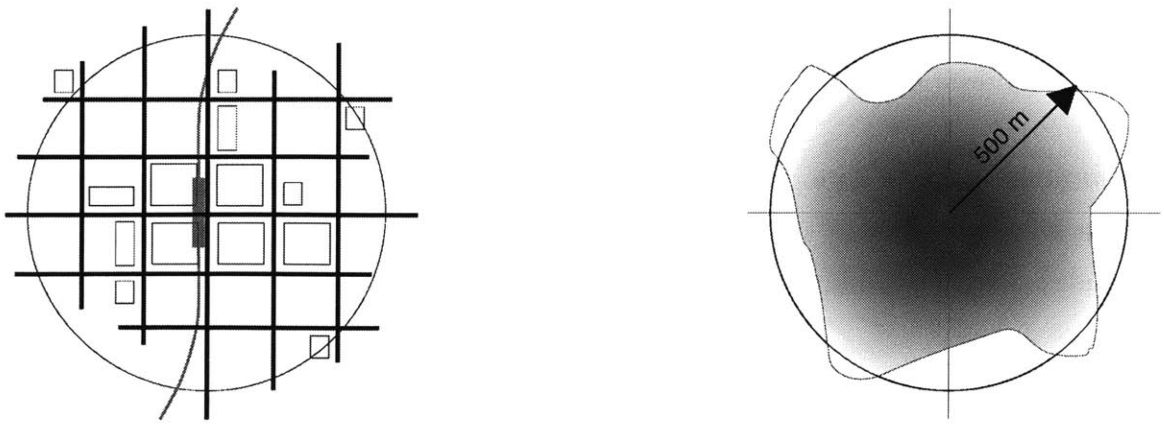

Figure 1.3 *Optimal station location*

The station (left diagram, center) is able to attract pedestrians from nearly the entire theoretical catchment area (right diagram); the irregular line shows the limits of pedestrian origins and destinations, while the shading denotes their relative density

Central Station in Cambridge, Massachusetts, provides an example of a station in an ideal location (see Figure 1.4). Directly under the city's Central Square, which includes a pedestrian plaza, the station is convenient to City Hall, a post office, office buildings, numerous shops and restaurants, as well as to the homes of many Cambridge residents. All are connected by generous sidewalks along short blocks. As a result, the majority of passengers boarding the Red Line at Central Station—nearly 82 percent—walk to the station, according to the MBTA's most recent ridership survey.[8]

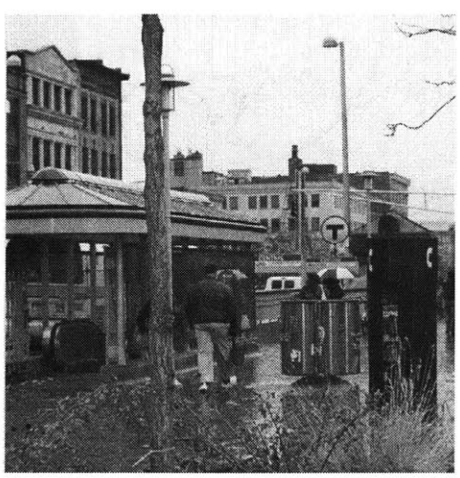

Figure 1.4 ***Central Station***
Cambridge, Massachusetts

Many origins and destinations near the station, oriented along streets with wide sidewalks, encourage a high level of pedestrian access.

[8] Falbel 1997
MBTA = Massachusetts Bay Transportation Authority

Compromised Station Siting

Unfortunately, many stations are in pedestrian-unfriendly environments where walk-up access is compromised by any number of conditions. As shown in Figure 1.5, these could include any of or a combination of the following:

- being away from the center of a walkable, pedestrian-friendly environment (left diagram, right)
- a location in an area of dispersed development with a poorly connected street network (left diagram, left)
- a location next to a barrier such as an expressway or railroad corridor (left diagram, center)
- a design that places parking lots or transfer facilities in the way of pedestrian access (left diagram, center)

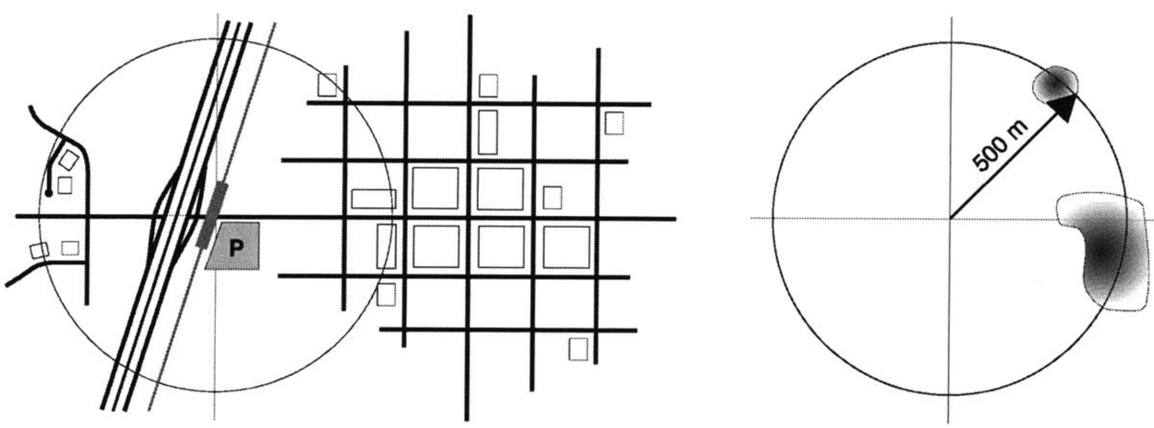

Figure 1.5 ***Compromised station location***

The station (left diagram, center) is only able to attract pedestrians from isolated locations at the edge of its theoretical catchment area (right diagram); few walkable destinations are located closer in, and the expressway blocks pedestrians who might be originating from the more dispersed development (at left)

Alewife Station, also in Cambridge, provides an example of a station where pedestrian access is compromised (see Figure 1.6). A busy arterial and open space separates the station from neighborhoods and office buildings. A railroad corridor blocks routes to a shopping center that is itself dominated by parking lots. Finally, the station is surrounded by an enormous parking structure that obscures the station's pedestrian entrances. Slightly less than 15 percent of Red Line riders boarding at Alewife walked to the station.[9]

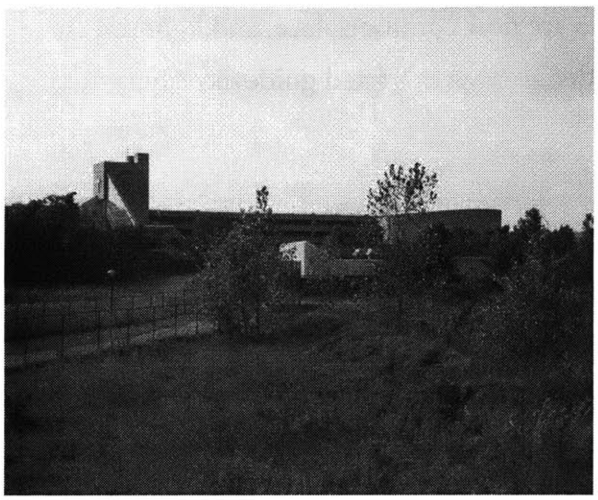

Figure 1.6 ***Alewife Station***
Cambridge, Massachusetts

The station's relatively isolated location and insular design, largely a result of efforts to accommodate park-and-ride access, result in a low level of pedestrian access

Constraints on Optimal Station Siting

Defining alignments for rail transit lines and designating station locations is a complex process that involves many considerations, stakeholders, and limitations. There are a number of constraints that lead to the choice of siting stations in locations compromised with respect to pedestrian access.

- ***Political Constraints.*** Transit stations are one of the most common objects of so-called NIMBY protests.[10] They represent a large investment that cannot help but introduce change around them. Despite the benefits that fast connections to other parts of a metropolitan area provide, stations are often resisted because of the disruption caused by their construction and the fear that they will raise crime or attract undesirable development.

[9] Falbel 1997

Stations also create a demand for parking on neighborhood streets, which is also undesired. When the Metro system was being planned in Washington, D.C., in the 1960s, additional development was resisted in the Georgetown district. Because of this, the Orange and Blue Lines were designed to connect directly between the city's Foggy Bottom section and Rosslyn in Arlington County, Virginia, without a station in Georgetown. It is within walking distance of Rosslyn Station by way of a bridge over the Potomac River, but busy intersections are obstacles to pedestrian access. Having emerged as a retail and residential center, traffic jams in Georgetown are now commonplace, and light rail or Metro extensions into the district are identified in WMATA's fixed guideway expansion plans.[11]

- *Financial Constraints.* Pedestrian-friendly environments are typically in built-up areas that are difficult to serve with rail transit without incurring prohibitive costs. In order to keep the cost of projects under control, elevated alignments may be built on the edge of activity instead of more expensive underground tunnels that would bring the station nearer to pedestrian origins and destinations. Existing highway and railroad corridors are especially attractive, because they often include available right-of-way that can be obtained at low cost. These, however, typically include a city's least walkable environments. Due in part to cost considerations, Los Angeles County MTA's Green Line was not built with a station at Los Angeles International Airport. This would have necessitated a diversion from the line's freeway-median alignment into a tunnel. The nearest station on the line, Aviation/I-105, is over 2 km (1.4 miles) away from the airport terminals, outside of walking distance even if the intervening environment were pedestrian-friendly. A shuttle bus or a taxi are the only realistic options for reaching the airport from the station.[12]

- *Engineering Constraints.* Even if money were no object, it may be impossible for a transit line to penetrate a pedestrian-friendly environment. Dense development may preclude an at-grade or elevated line, and poor soil conditions may rule out an

[10] "NIMBY" is derived from the phrase "*n*ot *i*n *my* *b*ackyard"
[11] WMATA 1999, 9-11

underground alignment. The broader context of a line may dictate that a station be placed in a less than optimal location because of topography, vehicle operating dynamics, or the desired locations for other stations. Miami's high ground water levels put subway construction out of the question, necessitating the alignment of its MetroRail line on elevated structures on the edge of downtown. MetroMover, an automated people mover system, provides connections between MetroRail throughout the central business district. The need for this additional system and the accompanying transfers would have arguably been unnecessary with MetroRail stations closer to downtown destinations and linked to them with attractive pedestrian routes.[13]

- ***Contextual Constraints.*** Finally, stations may be sited in pedestrian-unfriendly conditions simply because the areas that the planned transit line will serve are not walkable environments to begin with. This is the case for many modern transit stations that are built in auto-dominated suburban areas. These stations are not designed with the pedestrian in mind, but with extensive park-and-ride lots sited so as to be convenient for motorists. Terminals like Alewife Station are typical of them, as is MARTA's Indian Creek Station in Dekalb County, Georgia. Ramps from I-285 offer easy access to the station's 2,500 parking spaces, but pedestrian connections to surrounding subdivisions are limited (see Figure 1.7).[14]

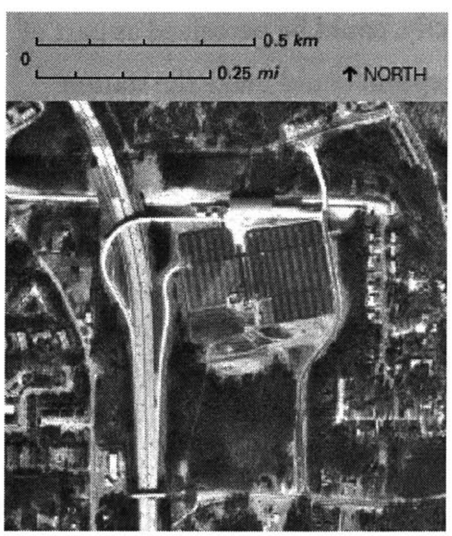

Figure 1.7 ***Indian Creek Station***
Dekalb County, Georgia

Pedestrian access from the neighborhood to the west is blocked by I-285, and no pedestrian routes connect through the station's wooded surroundings to the neighborhood to the east

[12] Los Angeles County Metropolitan Transportation Authority (MTA) 2001
[13] Schwandl 2000

1.3 Research Objectives and Methodology

This section outlines the objectives, approach, and methodology of the research presented in this thesis, introducing the content of the chapters to follow.

1.3.1 Research Objectives

This thesis seeks to find ways of overcoming the impediments to pedestrian access inherent to many station locations. Unfortunately transit stations are and will be sited in pedestrian-unfriendly environments. Despite the best efforts and intentions, compromises often have to be made that discourage walk-up access. Regardless of the underlying causes of the impediments, improvements can be made to rectify them. These means can be classified into either or both of two categories, as illustrated below.

- *The station "reaches out" to surrounding development.* This can be "reaching" in a very literal sense, such as an extension of the actual station. In Figure 1.8 below, this is shown by a pedestrian bridge that reaches across the expressway to attract walk-up access from the neighborhood to the west. It can also be more conceptual in nature. The figure below also shows a plaza (square at left) that, if designed correctly, could be perceived as part of the station even though it is separated from it. This perception could make the station appear less distant and more accessible, thereby encouraging more riders to walk to it. Likewise, information about the station and transit services can be placed at remote locations, expanding the "reach" of the station.

[14] MARTA 2001

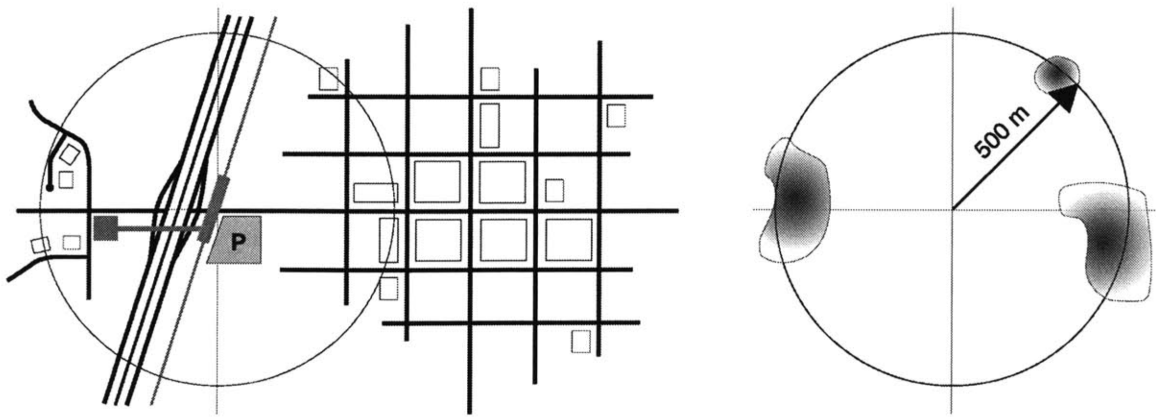

Figure 1.8 ***A compromised station "reaches out" (to the left)***

With a pedestrian bridge and plaza, the station is able to attract a greater level of walk-up access from its theoretical catchment area

- *Surrounding development "reaches in" to the station.* Figure 1.9 shows how new development adds origins and destinations within the station catchment area. Oriented along walkable streets that connect with the older, more distant development, pedestrians are encouraged to walk that longer distance. As in the "reaching out" case, "reaching in" can occur on a more abstract fashion—by means of higher densities, for example. This is shown in the figure by a parking structure that replaces the parking lot.

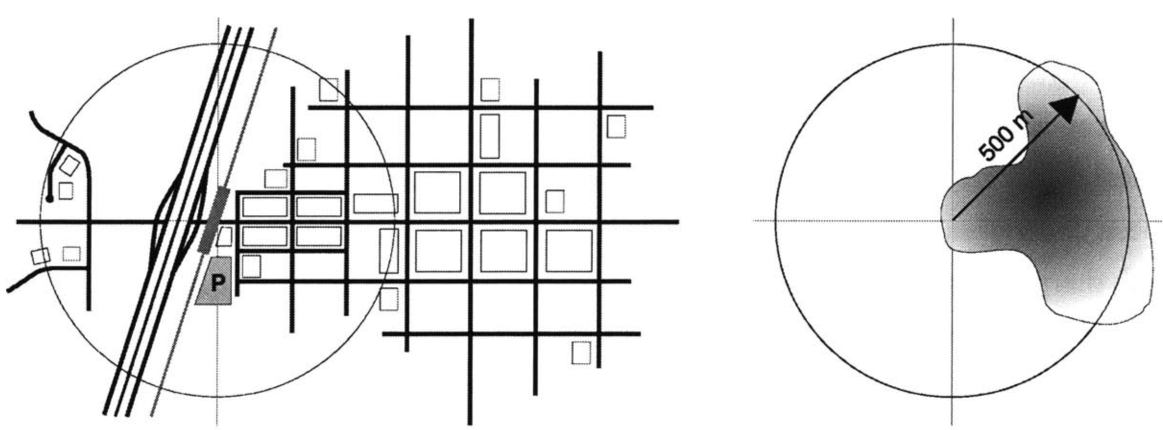

Figure 1.9 ***Surroundings "reach in" to compromised station (from right)***

New development, an extension of the existing street network, and greater densities (illustrated by the parking structure) encourage more pedestrian access within the theoretical catchment area

The objectives of this research are to:

- Identify the impediments to pedestrian access at transit stations (Chapter Three);
- Establish what encourages and discourages individuals from walking as a transportation mode in general (Chapter Four);
- Determine how stations may "reach out", or how their surroundings may "reach in", to encourage additional pedestrian access (Chapters Three and Four);

These findings are then applied to two transit systems, Tren Urbano in metropolitan San Juan and the rapid transit lines of Chicago (Chapter Five):

- Assess the walking conditions around several stations in the two urban areas;
- Recommend a strategy for each station area identifying appropriate interventions for improving pedestrian access.

1.3.2 Research Approach

This research attempts to achieve a clearer understanding of pedestrian behavior by focusing on the details that contribute to or detract from an environment in which people feel comfortable walking. "Walkable" is one of many adjectives that tries to describe what these details are, but remains vague. The examination of various studies and surveys has been undertaken to find evidence to support these details, bringing them into focus. With this sharper perspective, guidelines can be formulated that can then be applied to the specific case of pedestrian access to transit stations.

A clearer understanding of pedestrian behavior can help transit authorities as they design and rehabilitate their infrastructure. It can also aid in their recognition of the importance walk-up access plays in the success of their systems. It is just as important for other jurisdictions and private developers to understand the benefits of additional pedestrian activity around stations. Many of the interventions that would encourage walking to stations lie beyond transit authority property and must be funded and undertaken by other public agencies, municipalities, and private property owners. This research recognizes the difficulty this presents, while providing precedents and success stories that demonstrate the value of such efforts.

1.3.3 Research Methodology

Before the 1960s, when Jane Jacobs wrote about how people walking in her New York City neighborhood made it such a desirable place to live, and William Whyte made a science of pedestrian activity, little was known about the subject.[15] However, as cities began to lose their pedestrian-friendly qualities, the contrast between the "walkable" and the "non-walkable" became greater, prompting study and research. Little has been written, however, about the relationship between pedestrians and transit. This inattention is manifested by the design of many new transit stations as insular transfer pods that do not cater to pedestrian needs. The "New Urbanism", a planning and architectural movement that started in the early 1990s, has addressed itself to this. Championing both walking and transit and advocating for better connections between the two, the movement's enthusiasm has not been attended by comparable efforts to find evidence supporting the value of these activities.

This thesis has applied research that has been done on pedestrian behavior and travel to the transit case. Sources outside of academia, including the publications, statistics and surveys of transit authorities and their consultants as well as contact with advocates, professionals, and practitioners intimately involved with the pedestrian-transit relationship have facilitated this application. This has involved a broad spectrum of fields, including transportation engineering and planning, urban planning and design, architecture, graphic design, marketing, and environmental psychology. All add insight into what encourages or discourages pedestrian access to various transit stations across

[15] Jacobs 1961 and Whyte 1980

the U.S. With the greater understanding this provides, recommendations for application in two very different urban areas can be advanced.

1.4 Context for Application

This research illustrates the challenges and opportunities for improving pedestrian access to transit stations through the case of an entirely new transit system, Tren Urbano in metropolitan San Juan, as well as through one that is well established, the rapid transit lines operated by the Chicago Transit Authority (CTA).

1.4.1 Tren Urbano

The Puerto Rico Highway and Transportation Authority (PRHTA) has undertaken the construction of a heavy-rail rapid transit system, called Tren Urbano, in the San Juan Metropolitan Area. The first phase, a 17 km (10.6 mile) line connecting the Santurce district of San Juan with Bayamón, the island's second largest city, is scheduled for revenue operations by 2004. Future phases are planned to connect to other parts of the metropolitan area, the majority of which can be characterized as low-density, automobile-oriented sprawl. This means that Tren Urbano stations are invariably compromised with respect to pedestrian access. The potential for Tren Urbano to alleviate the severe traffic congestion of the metropolitan area cannot be fully met if access to stations occurs overwhelmingly by feeder services and automobiles. The advent of Tren Urbano promises to usher in a new way of thinking about mobility in an area where transit has played a minor role for decades. It can also be the catalyst for addressing the meager pedestrian environments in the neighborhoods around future stations.

Application of this research to an entirely new transit system, especially to future phases that are as yet only conceptually defined, will identify the long-term efforts that can assure a walkable station environment on opening day. The opportunity to maximize the transit system's potential from the start is possible given the long gestation period that lies ahead.

The guidelines and recommendations presented in this thesis, along with the experiences of station area planning efforts carried out for Tren Urbano stations currently under construction, can provide the foundation for pedestrian access strategies for future phases. This would comprise the catalyst that could turn the pedestrian-unfriendly conditions prevalent in much of metropolitan San Juan to walkable environments contributing to a more sustainable future for the Caribbean's premier urban center.

1.4.2 CTA Rapid Transit

The Chicago Transit Authority (CTA) operates the second largest transit system in the United States, serving one million bus riders and half a million rail riders each weekday. Its service area incorporates the City of Chicago and 38 surrounding cities and towns, with a total population of 3.7 million. Services are provided on seven rapid transit lines totaling 223 miles in length, some of which originally began service in the 1880s.[16] CTA's rapid transit lines of recent vintage have been built in the middle of expressways or in railroad corridors, providing prototypical examples of compromised stations. With the City of Chicago reversing a long-standing decline in population, and growing ridership on the CTA presided over by a more progressive, proactive leadership and management, the issue of pedestrian access to rapid transit stations has become a timely matter.

Application of this research to an established, older system will uncover the difficulties that entrenched policies and outdated paradigms present to pedestrian access to stations. It also allows quick, short-term interventions to be implemented and tested with respect to their success. These can then inform similar projects elsewhere in the system and guide long-term efforts. The guidelines developed and recommendations proposed in this thesis will hopefully gain from the current momentum CTA is experiencing and lead to the development of an expanded pedestrian access strategy. This would fill the void between the authority's station rehabilitation plans, which do not address issues outside of CTA

[16] CTA 1999, 2
CTA 1996, 1

property, and the City of Chicago's transit-oriented development proposals, whose broader scope often misses the details so crucial to pedestrian access. A strategy for improved connections between Chicago's neighborhoods and its transit system will sustain CTA's ridership growth and enhance the city's attractiveness.

Chapter Two
THE CASE FOR PEDESTRIAN ACCESS

2.1 The Benefits of Improved Pedestrian Access

Walking is the great common denominator in transportation as "the most affordable and accessible of modes."[1] This section reviews multiple reasons why attention to pedestrian access to stations is crucial to transit's success. Its main contributions to transit's viability include the

- expansion of transit markets and
- increased ridership;

with wider benefits to society and community, among them:

- reduced air pollution,
- enhanced development potential,
- more equitable mobility opportunities,
- improved individual health, and
- a better quality of life.

The word "pedestrian" is used throughout this thesis, although a wider group of individuals is actually meant. "Pedestrians" include the wheelchair-bound as well as young children pushed in strollers. "Non-motorized access" is an awkward replacement for "pedestrian access", and would exclude users of motorized wheelchairs while including bicyclists, whose needs are related to but not identical to those of "pedestrians". For lack of better terms, "pedestrian" is applied to all individuals not traveling by automobile, motorcycle, or moped; bus or other public vehicle; nor by bicycle, regardless of whether they are actually walking or not. Similarly, the terms "walking" and "walk-up access" apply to wheelchair travel.

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[1] POTED 1998, *Portland Pedestrian Master Plan* 1

2.2 Benefits to Transit

2.2.1 Ridership Market Expansion

The growth of automobile travel in the mid-twentieth century was attended by a decline in transit ridership, leaving largely "captive riders" using the various rail systems that continued to operate. The new transit lines that have been built in recent years hope to attract riders who have other mobility options, and convenient parking and free transfers from buses are used as a means of accomplishing this. Transit-dependent individuals may be more likely to walk to stations than other groups, but they are by no means the only beneficiaries of improvements to pedestrian access. Choice riders, which comprise a surprisingly large and growing component of transit ridership, may be encouraged to use transit more often if pedestrian routes to stations are attractive and convenient. Indeed, those who rarely use rail transit, especially if it involves fighting for parking at a park-and-ride or riding a bus and having to transfer, may give it a try if the walk to the station is seen as a more desirable alternative. This is especially the case when offices, shopping, and residents are built near stations and connected to them by walkable environments.

Examples of such transit-oriented development are appearing across the U.S., even in cities largely dominated by automobiles. Rail transit is an oddity for many Texans, but Dallas Area Rapid Transit's (DART) light rail "starter system" has attracted ridership in unexpected numbers and stimulated much station-area development in its first five years of operation. Ken Hughes is a Dallas developer who has capitalized on people's desire to live within walking distance of DART. His firm has built 250 high-end loft apartments, an art theater, restaurants and boutiques tightly linked to DART's Mockingbird Station with a pedestrian plaza. "I tell potential residents that the rail station is the front door to the development," he says. "Once people see how closely we are identified with [the station], they see the potential for taking the train instead of driving."[2] Hughes is not simply making a sales pitch; the development, through its design and orientation, really does

[2] Heimberg 2000, 6

make the rail station its front door (see Figure 2.1). The high-income residents he is attracting to the lofts and the people frequenting the restaurants and shops below them do not typically belong to transit-dependent markets. They are not likely to have used DART before when it ran only buses. The increased level of service provided by rail coupled with a walkable environment around stations has targeted non-traditional markets.

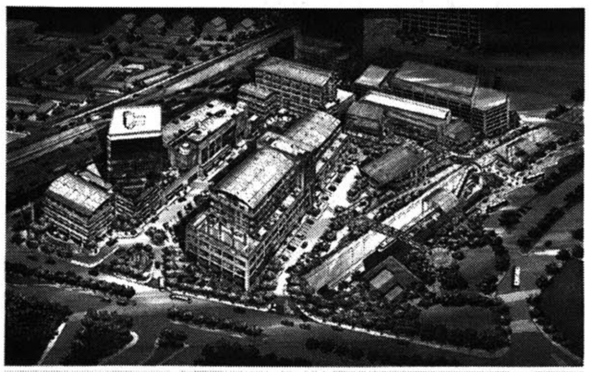

Figure 2.1

Mockingbird DART Station
Dallas, Texas

The station, in a depressed cut (bottom center to upper right), is crossed by pedestrian bridges connecting bus transfer areas and parking with a mixed-use development, including an adaptive reuse of an industrial building for loft apartments

2.2.2 Potential Ridership Increases

As improved pedestrian access to transit makes it attractive to wider markets, this will be attended by increased ridership. A trip with any other mode includes at least some small component of walking, and this is certainly the case with rail transit. If they do not actually walk to stations, individuals walk to an automobile that will be parked at the station, or to a stop to catch a bus. At the station, parking or alighting from the bus is followed by a walk to the station entrance and to platforms. Following the rail transit ride, this same pattern, or "hierarchy" in the words of noted planners Peter Calthorpe and William Fulton, is repeated. They advise that

> transit should be conceived in a hierarchical form; starting with walkable and "bikeable" streets supporting local bus routes feeding into trunk transit lines with dedicated rights-of-way. This hierarchy is essential to transit's success. Leave out any element and the system becomes inefficient and inconvenient, resulting in what we now have—systems that need more subsidies than possible and systems that cannot attract a growing ridership. Each element—walkable places, local buses, and

> convenient trunk lines—is critical. Without walkable and bikeable destinations and origins, transit riders are stranded at each end of their trip.[3]

Of course, people will not choose to put themselves in a position where they might be stranded, and consequently are likely to avoid transit in the first place if walkable environments are not present. Internal circulation within stations and connections to parking and bus transfer facilities are generally adequate; but good walking conditions beyond the perimeters of transit authority-owned property can hardly be taken for granted at many stations.

As in Dallas, new development in California's Silicon Valley is being tied to transit with walkable environments, leading to increased ridership on the Santa Clara Valley Transportation Authority's (VTA) light rail system. Housing developments for 15,000 have sprouted up along its Tasman West Line, prompting international firms, in turn, to locate their headquarters and expand nearby. As one of the firms' executive vice presidents explains, "for mass transit to work, you need a mass of riders who can go from home to work and never get in a car...that's what we have now." Because of this growth linked to light rail with pedestrian connections, VTA predicts an impressive jump in ridership to over 31,000 a day in 2001, up from 25,000 the previous year.[4] Illustrating the ridership growth potential within station areas, VTA has determined that residents living near light rail "use transit as their predominant commute mode more than five times as often as residents countywide."[5] As improvements are made to pedestrian access in station areas, even more residents can be attracted to transit.

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[3] Calthorpe and Fulton 2001, 215
[4] Goldfisher 2000

2.2 Wider Benefits to Society

2.3.1 Air Pollution Reduction

One important motivation behind the construction of transit lines is its potential to reduce automobile-generated air pollution and the respiratory ailments it causes. Replacing trips in low-occupancy vehicles with trips in higher-occupancy transit vehicles reduces emissions, particularly in the case of electrically powered rail transit. Transit investments coupled with more walkable environments, in which more trips become fully non-motorized, can have a synergistic effect realizing even greater emissions reductions.

In the early 1990s, 1000 Friends of Oregon developed the so-called LUTRAQ[6] alternative in response to plans for a western freeway bypass of Portland. In an unprecedented modeling exercise, a scenario was developed including a new light rail line with walkable, mixed-use centers around stations. Based on levels of walking and biking observed in Portland's established neighborhoods, the model incorporated factors predicting the amount of walking that would occur if developments along the new transit line were designed to mimic the qualities of the older, walkable neighborhoods instead of following a dispersed, auto-oriented pattern. As compared to the Bypass Highway alternative, which did not involve a transit line or pedestrian enhancements, the LUTRAQ model resulted in less air pollution (-6 to -8.7 percent) and less greenhouse gas emissions (-7.9 percent). This is not surprising, given that the LUTRAQ alternative predicted 27 percent more transit, walking, or biking trips and an 18 percent decrease in highway congestion, even without the freeway lanes the bypass alternative added.[7] A transit line without the accompanying land use changes, however, would not have realized the same air quality benefits.

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[5] Santa Clara VTA 2000, 2
[6] LUTRAQ is derived from the phrase "Making the *L*and *U*se *T*ransportation *A*ir *Q*uality Connection"
[7] Calthorpe and Fulton 2001, 113

Improved pedestrian access to stations can be especially beneficial to reducing air pollution when it replaces short trips to park-and-ride lots. Although stations may be near, transit patrons may choose to drive to them because walking conditions are unsatisfactory. These short trips involving "cold starts" are especially polluting, because catalytic converters that reduce hydrocarbon and carbon monoxide emissions do not reach full functionality until warmed up.[8] In fact, half of the ozone-forming emissions of an automobile trip are typically formed during the first one to two minutes after a cold start.[9] Thus, greater reductions in air pollution may be realized not by encouraging motorists to drive less, but to eliminate short trips. Better walking conditions around transit stations can replace the short park-and-ride-bound trip, as well as introduce the opportunity for substituting other car trips within the station area (i.e., for errands) with walk trips.

2.3.2 Transit as an Armature for Development

Pedestrian trips in station areas are proportional to the density of development around them. The examples from Santa Clara County and Dallas demonstrate transit's potential to attract development. Studies at the University of North Texas' Center for Economic Development and Research have shown that values of properties adjoining DART light rail stations grew 25 percent more than similar properties not served by the rail system. Rents at Class A office buildings near stations jumped from an average of slightly less than $16 to $23 between 1994 and 1998.[10] As Ken Hughes explains, "the proximity of the DART station and growing ridership made the Mockingbird Station project attractive and doable..."[11]

The development potential of transit is greatly enhanced by pedestrian connections to stations, because it allows space otherwise needed for automobiles to be used for pedestrian-oriented uses instead. This allows higher densities, creating nodes or corridors

[8] Noel 1998
[9] Air and Radiation Division 2001
[10] DART light rail service began in 1996.
[11] Heimberg 2000, 3

that ultimately become armatures for a region's growth and development. This has been the experience of Arlington County, Virginia. In the 1970s, the county decided to capitalize on the investment of WMATA's[12] Orange Line to reverse the decline of the commercial corridor between its Rosslyn and Ballston neighborhoods. High-density, high-rise office, retail and residential uses were zoned around stations, with a gradual tapering to leave surrounding single-family homes untouched just blocks away. Street improvements were made to accommodate pedestrians, while parking at the stations, initially provided, has been phased out. A county planner notes:

> We were willing to go through a major community transformation in order to maximize the value of this transit system...the feeling was that people could live and work near transit, and it should have a beneficial effect. And it has. We simply don't have the kinds of traffic problems that exist elsewhere.[13]

Besides attracting growth and spurring redevelopment, therein lies a great motivation behind transit in the first place—reducing traffic congestion. The paradox of added growth and higher densities accompanied by fewer—not greater—traffic problems is made possible to a large extent by walkable environments that couple pedestrian and transit trips and take cars off the road.

2.3.3 Equity Benefits

Unlike the generations that have gone before who lived before the age of individual, motorized transportation, few Americans today are able to meet all of their daily needs within walking distance. The automobile overwhelmingly facilitates the growing number of trips between ever more dispersed origins and destinations, as investments and policies have favored driving above other modes. However, significant segments of the population—including the youth, disabled, and elderly—cannot drive, and still others cannot afford a vehicle. As a result, these populations are marginalized and isolated unless they can take advantage of alternative transportation modes.

[12] WMATA = Washington Metropolitan Area Transit Authority

One of the strongest arguments for transit is that it provides mobility to the carless populations mentioned above, attempting to right the inequities of an autocentric society. Unfortunately, transit authorities are often charged with neglecting these mobility-impaired groups, particularly as they pursue capital-intensive projects. The construction of rail lines with park-and-ride stations in affluent suburban communities is often seen as a diversion of funds from more transit-dependent communities closer to urban centers. Such projects are even accused of promoting sprawl and adding to congestion and pollution because they make living in far-flung, auto-dependent suburbs attractive to those who work near the downtown termini.

While that debate rages on, the fact remains that park-and-ride lots are expensive to build and benefit only motorists. Even when parking fees are charged (and often they are not) they do not fully cover the parking lot construction and maintenance costs. Of course, the transit ride itself is subsidized, so the argument may be made that using subsidies for parking is legitimate because it is an integral part of making the transit system work. However, those funds could be used for providing additional transit service or facilities for non-motorized access as well. Unfortunately, pedestrian access is often not considered an integral component of making a new transit line work.

Shelley Smith offers the following figures on the cost of parking facilities:

> Capital costs for simple surface parking lots are $7,967 per space, with an annual operating cost of $995. Multilevel parking structures can cost as much as $60,857 per space to build, with annual costs of $4,504.[14]

These figures may be more reflective of conditions in downtowns, where real estate is at a premium. WMATA, which provides over 55,000 parking spaces at its suburban Metrorail stations, spends about $5,000 to build each surface stall, and up to $13,000 per garage stall. Charging no more than $2.25 a day for parking, the maximum annual revenue of around $550 per space obviously does not completely cover the operating costs.[15]

[13] Layton 2001
[14] Smith 1990, 38
[15] WMATA 2001, "Parking at Metro Stations"

Improving pedestrian access with investments comparable to those expended for parking would improve the equity of transit systems. The final segment of WMATA's Green Line connecting Washington's Anacostia neighborhood with Prince George's County, Maryland, cost $761 million to build. Of that, about $54 million—seven percent—was spent on parking lots and structures.[16] In comparison, the City of Portland has priced comprehensive projects for improving pedestrian access within a 500 m (1,575 ft) radius of two Eastside MAX light rail stations at $500,000 and $750,000 each. These projects would include sidewalks, crossing improvements, and enhanced amenities.[17] If these investments and comparable ones at each of the Eastside MAX stations had been made in conjunction with the line's construction, this would have added $14 million to the project's $214 million cost—also about seven percent.[18]

While Metro parking lots and park-and-rides at transit stations across the nation are considered a given, the two projects included in the Portland Pedestrian Master Plan are unique. Additionally, they are a city-funded undertaking independent of Tri-Met, the transit authority, while Metro parking is included in WMATA's budgets, as are park-and-rides on the balance sheets of virtually all transit authorities. Investments to improve pedestrian access to stations address equity issues, leveling the playing field between auto and walk-up access and meeting the needs of transit-dependent groups.

2.3.4 Individual Health Benefits

Experts tracking disease in the United States have identified sedentary lifestyles as a major threat to individual health. Since 1970, vehicle miles traveled (VMT) have increased 120 percent while walking has suffered a 40 percent decline nationwide. This has been attended by a dramatic rise in the proportion of the population classified as "overweight",

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Parking fees (ranging from $1 to $2.25) are only charged on weekdays and not on holidays. Assuming each space is used every day, at a rate of once a day, the maximum annual revenue is $2.25 × 250 = $562.50.

[16] WMATA 2001, "Green Line to Branch Ave Grand Opening" and "Parking Facility Inventory"

[17] POTED 1998, *Portland Pedestrian Master Plan* 29, E-5

which is now applicable to more than half of the adult population. An "epidemic of obesity" is spoken of, with one in four suffering from this more extreme condition. Nearly a third of adults (29%) are sedentary, meaning they have no daily physical activity at all, putting them at risk of cardiovascular disease, cancer, and diabetes.[19] These alarming statistics are directly attributable to the decline in pedestrian travel, which is due in part to a lack of walkable environments in much of America's metropolitan areas.

Based on these observations, the Centers for Disease Control and Prevention (CDC) have expanded the institution's mission beyond viruses and immunization to transportation and land use policy. Richard Killingsworth and Tom Schmid of CDC observe that while "sedentary lifestyles in the U.S. may be a primary factor in 200,000 deaths each year...people would register significant benefits if they took two 15-minute walking or bicycle trips on most days of the week."[20] A daily walk to and from a transit station easily fills this prescription for better health. Distances between home, work and shopping may be too great for walking or biking, but an intermediate transit trip could enable time-pressed individuals to get needed exercise and commute at the same time. Those who already use transit regularly but arrive at stations by auto or bus may be able to walk or bike instead, introducing beneficial physical activity to their daily routine. The quality of pedestrian access to transit stations, however, has a great impact on the willingness to walk, as will be discussed in later chapters. Thus, by encouraging more walking, improvements to pedestrian access to stations can realize individual health benefits.

2.3.5 Quality of Life Improvements

The ability of improved pedestrian environments to allow growth to occur in transit-served corridors and nodes without concurrent rises in traffic congestion offers real hope for America's burgeoning metropolitan areas. These benefits on a regional scale, however, really are based on those that accrue individually. Besides the health-related benefits and

[18] Closely spaced and in Portland's very walkable downtown, 11 stations are not included in this calculation. A $750,000 investment around the 19 stations outside of downtown would amount to $14.25 million, 6.7% of $214 million.
[19] Killingsworth 2000

the increased mobility described earlier, a number of other improvements to quality of life can be gained through improved pedestrian access to transit.

- *Connecting neighborhoods back together.* Barriers such as busy highways, railroad corridors, and insular development impede access to many transit stations. In particular, interstate highways have often cut neighborhoods in half, leaving few opportunities for crossing and leaving little alternative to driving to nearby destinations. Improved pedestrian access to stations establishes better links within and between neighborhoods that benefit all, not only those bound for the station.

- *Improving housing opportunities.* Homebuyers in walkable neighborhoods near transit can often do without a second car or without any car at all. In recent years, lenders have realized that families living in these neighborhoods are less financially burdened than their counterparts in auto-dominated subdivisions, and that this can be applied to their mortgages. With such "location efficient mortgages," homebuyers can afford better housing.[21]

- *A more enriching social environment.* Walkable environments allow individuals to meet and associate with one another face-to-face, as opposed to through television screens, computer monitors, or car windshields. Individuals in environments where walking is difficult, inconvenient or uncomfortable often lead rather isolated lives. As Wendy Smith writes,

> Pushing a stroller along the sidewalk, you naturally meet the eyes of other parents similarly occupied; after running into them again and again...you're bound to strike up acquaintanceships. You can't make those kinds of connections when all your travel time is spent in a car... When I talk to new mothers who live in the suburbs, the emotion they most often express is a paralyzing feeling of loneliness and isolation. This sentiment is not unknown to urban mothers, but the density of cities mitigates it."[22]

[20] Killingsworth and Schmid 2000, 64
[21] Grimshaw 2000, 38
[22] Smith 2000

Of course, the essence is not density, although a walkable environment often accompanies it. Dense cities can often be very pedestrian-unfriendly, just as lower-density suburbs can be great places to walk. What can make meager walking conditions in either location better are the same kinds of improvements that also facilitate walking to transit stations.

2.4 Conclusion

Given the importance of pedestrian access to transit stations, it is disappointing that relatively little thought and attention is paid to it. This negligence can mean that the benefits described in this section may not be fully realized, even at stations in pedestrian-friendly environments. For stations in poor walking environments, the missed opportunities are even greater. The next section describes the implications that station siting decisions have on encouraging or discouraging walking as an access mode.

Chapter Three
STATION AREA CASE STUDIES

3.1 Introduction

In order to understand what impedes pedestrian access at transit stations and determine ways to improve this access, stations of various rail transit systems were analyzed as case studies. While examples from abroad can provide many useful lessons, it was determined that case studies within the United States would be most instructive for application to Puerto Rico's Tren Urbano and the Chicago Transit Authority's rapid transit lines. Patterns of development, auto ownership rates, and transit ridership levels differ markedly in most areas of the world in comparison to the U.S., so that it is more difficult to apply what works and does not work at transit stations in other countries in an American context.

In the United States, there are now around two dozen cities with rail transit systems, and many more are planning lines of their own. Each of the hundreds of transit stations in these systems is accessed by pedestrians to some degree. Many are of the variety that are situated in walkable environments—particularly those built prior to, or introduced into areas developed before widespread automobile use. Still many others are in locations compromised with respect to pedestrian access—the situation that is the focus of this research. These compromised stations offered possible case studies for analysis.

Compromised stations and their pedestrian-related shortcomings are relatively easy to identify; those where interventions have been undertaken to improve walk-up access are more difficult to find. These, of course, are the ones that can offer lessons for guiding similar improvements at other stations. In many cases, a lack of documentation about the history of station areas precludes a determination that pedestrian access has been improved; in others, the impact of a specific intervention cannot readily be isolated or measured.

Because of these difficulties, findings are included in this chapter as well as in the following chapter, "Factors Influencing Pedestrian Access". Those included later in the following chapter either are more general or system-related, as opposed to concerning specific stations, or involve details that do not warrant an entire case study. They offer more in the way of evidence supporting the efficacy of certain interventions. On the other hand, the case studies that are presented here—involving recently built stations and as yet-unimplemented plans for an older station—develop a methodology of evaluating how pedestrian access is addressed at transit stations.

To cover a wide range of the difficulties facing compromised stations, the case studies span the entire spectrum of station area environments, from a dense, urban location, to an inner suburban, "greyfield" context, to outer suburban, "greenfield" conditions:

development context	***station name*** *line designation*	*location* *transit authority*
urban	**Charles/MGH** Red Line Rapid Transit	Boston Massachusetts Bay Transportation Authority (Boston, Massachusetts)
inner suburb "greyfield"	**Littleton/Downtown** **Oxford** **Englewood** Central/Southwest Corridor Light Rail	Littleton Sheridan Englewood Regional Transportation District (Denver, Colorado)
outer suburb "greenfield"	**Orenco/NW 231st** Westside MAX Light Rail	Hillsboro Tri-County Metropolitan Transportation District of Oregon (Portland, Oregon)

Table 3.1 Case Study Stations

3.2 An Urban Station: Charles/MGH

3.2.1 Station Context

Charles/MGH is the last station in Boston served by the Massachusetts Bay Transportation Authority's (MBTA) Red Line before it travels west over the Charles River to the neighboring city of Cambridge. This elevated station is situated in the middle of one of the city's busiest intersections, Charles Circle, and serves the dense residential neighborhoods of Beacon Hill and the West End. As included in the station's name, Massachusetts General Hospital (MGH) adjoins the station and Massachusetts Eye and Ear Infirmary (MEEI) is also nearby. Charles and Cambridge Streets, fanning out from Charles Circle, include many retail establishments. Additionally, favored places to spend leisure time, including the Esplanade and the Charles River Basin, are within the station's reaches.

The Cambridge–Dorchester rapid transit line (as the Red Line was originally known) was constructed through this western section of Central Boston in 1912, emerging from tunnel near the location of the present station to assume an elevated position above Cambridge Street and Charles Circle before traveling across the Longfellow Bridge at the same elevation as parallel automobile traffic on either side. It was not until twenty years later that the station was constructed, due in part to the insistance of Massachusetts General Hospital. Despite having been an "afterthought", the station and its environs were nonetheless designed to fit very well within their context. The headhouse received a prominent position in the middle of Charles Circle as the focus of sightlines from Charles Street on both the north and south (see Figure 3.1). Pedestrian access was provided at-grade by wide walks radiating in several directions from the station entrance to the edge of the spacious, landscaped circle, as well as by an underground passageway (see Figure 3.2).

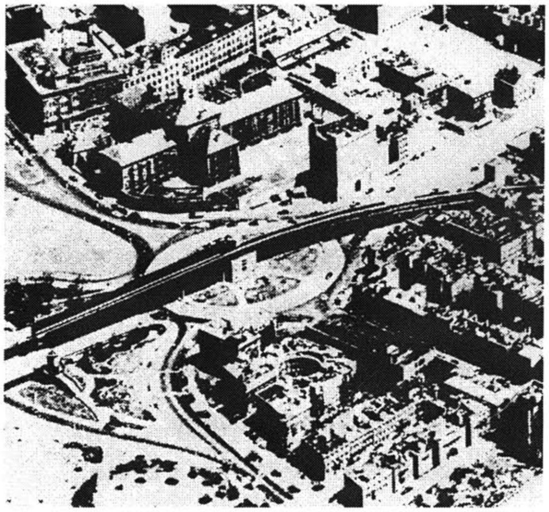

Figure 3.1

Aerial photo from the late 1940s shows that the headhouse is afforded a prominent position in the traffic circle

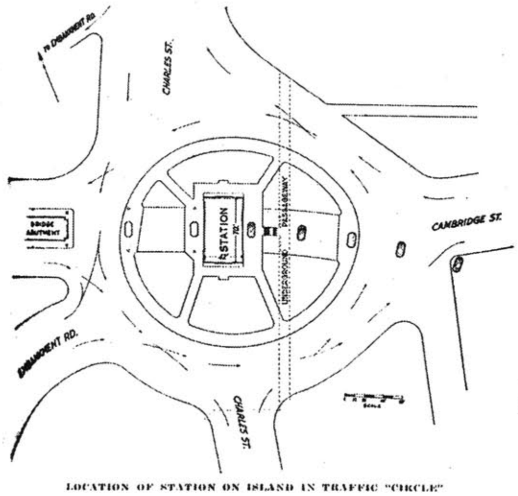

Figure 3.2

Original plan for station shows pedestrian walkways as well as underground passageway

3.2.2 Compromises to Pedestrian Access

In the 1950s, the Metropolitan District Commission (MDC) constructed Storrow Drive, introducing an urban expressway along the Charles River adjacent to the station site. This was accompanied by additional roadways at Charles Circle, which drastically altered both traffic circulation as well as the pedestrian environment. One of the roadways was placed between the exit of the underground passageway and the station headhouse. Never having been incorporated into the headhouse, the perception of security in the passageway already suffered from a lack of surveillance from MBTA staff. Thus the passageway became even less convenient and its security more problematic. In 1961, the MDC constructed overhead pedestrian bridges to the headhouse from the north and south sides of the traffic circle to mitigate the pedestrian/automobile conflicts introduced by the new roadways. At the same time, the MBTA closed ground level access and retrofitted a mezzanine level within the headhouse to receive patrons from the two bridges. Since the early 1960s, traffic has grown as has resident, tourist, and hospital-related pedestrian activity, continually worsening the conflicts between vehicles and pedestrians at Charles Circle.

Motivated by the station's outstanding status as one of the few on the Red Line completely inaccessible to people with disabilities, the MBTA initiated the process of station rehabilitation and reconstruction with a design competition in 1998. The issues faced by current users considered by the entrants include:

- *The primary mode of access to the station is on foot.* With the exception of small amounts of auto drop-off or bicycle access, everyone using the station is walking to it. Parking around the station is limited, and no bus routes serve it. Despite this, pedestrian access is unattractive and even difficult for many current and would-be patrons.

- *The pedestrian bridges to the station are inadequate.* Besides being completely inaccessible to the handicapped, the elderly and those temporarily disabled (i.e., hospital patients) simply may not be able to negotiate the 64 stairs from ground level to the platform (see Figure 3.3). The able-bodied find this unattractive as well, because they are required to go from street level to the bridge, down to the station mezzanine, and then back up again to the platforms. Both bridges are quite narrow—at 1.68 m (5.5 ft), individuals must pass each other in single file. The south bridge is uncovered and not lit, and while the north bride is enclosed and illuminated, homeless people often use it as a shelter.

- *The pedestrian bridges serve an important function apart from station access.* About half of the 15,000 daily users of the bridges are not Red Line passengers at all, but those wishing to cross from one side of Cambridge Street to the other. This figure is quite remarkable, as the bridges represent such a convoluted, unattractive route: such is the barrier to pedestrian crossing created by traffic at-grade. Still, mixed messages are given: at some locations at the circle, crosswalks are striped, yet have no pedestrian signals; and some of those crosswalks have no real destination. Occasionally, pedestrians trying to reach the station cross at grade and enter at ground level, although the doors are clearly marked NOT AN ENTRANCE.[1]

Figure 3.3

The pedestrian bridges and stairways are difficult for parents with young children (top) and the elderly (bottom) to negotiate

Figure 3.4

Traffic from Storrow Drive frequently backs up in the circle and vehicles encroach into the crosswalks, intimidating pedestrians

- *Traffic and poor station access seriously impact the quality of pedestrian activity.* Charles Circle is one of the city's most congested intersections, and queues often form on the eastbound Storrow Drive off-ramp entering the Circle. This causes traffic to back up on the through lanes of Storrow Drive and forces pedestrians at the Circle to weave through queued vehicles in order to cross the street (see Figure 3.4). The large number of pedestrian origins and destinations presupposes a pedestrian environment of much higher quality. To the west, Esplanade events and the recreational opportunities of the Charles River Basin beckon crowds; to the south, Charles Street and Beacon Hill attract tourists and residents alike. Major public and governmental institutions line Cambridge Street to the east; and to the north, world-renowned medical institutions depend on easy access. Particularly problematic is the rise in the outpatient component of hospital services due to changes in the health care sector, which has made the need for barrier-free access to the station more acute. The proximity of surrounding destinations creates an

[1] Elkus/Manfredi – HDR 2000, 14

expectation of direct and accessible connections that are in fact not available, or are seriously compromised by the Circle and station's current configuration.

3.2.3 Improving Pedestrian Access: An Accessibility and Modernization Program

The design competition provided a wealth of ideas on how to improve the failings of the station as described above. Each of the winning entries addressed the issue of pedestrian access in different ways.

- One concept extended the existing station to create new pedestrian-friendly entrances closer to Charles Street and the MGH/MEEI complex.
- Another explored completing the urban street line of the south side of the Circle with a new headhouse, allowing more direct routes of access and improving the walking environment along Cambridge Street.
- One entry proposed decking over the entire circle with a pedestrian plaza connecting the station with its neighbors.
- Still another suggested only modest modifications to existing conditions, but introduced a civic courtyard for MGH tied closely to the station.

With these ideas in mind, a joint venture of Elkus/Manfredi Architects, Ltd. – HDR undertook a five-month study in 2000 that developed three alternatives for station reconstruction and recommended one for implementation. The three alternatives and their implications for pedestrian access are described below.

- *Options A: Station at existing location.* Eight options were studied that either rehabilitated or constructed an enlarged headhouse at the current location, in each case exploring different means of access. Of these, rehabilitation with new and improved pedestrian bridges was selected as the preferred option. Additionally, at-grade connections could not be protected on both sides of the station, and tunnels would be difficult to supervise and maintain. The preferred "A" option would place accessible headhouses at the northern and southern edges of the circle (see Figure 3.5). While this would make access to the station handicapped-accessible, and provide wider, better-lit and enclosed passage, it still represents an inconvience. To accommodate minimum clearances, ramps down from the bridges to the station mezzanine would be required, imposing an up-down-up movement. Correspondingly, the passage from one side of the Circle to the other is somewhat improved, but not especially convenient.

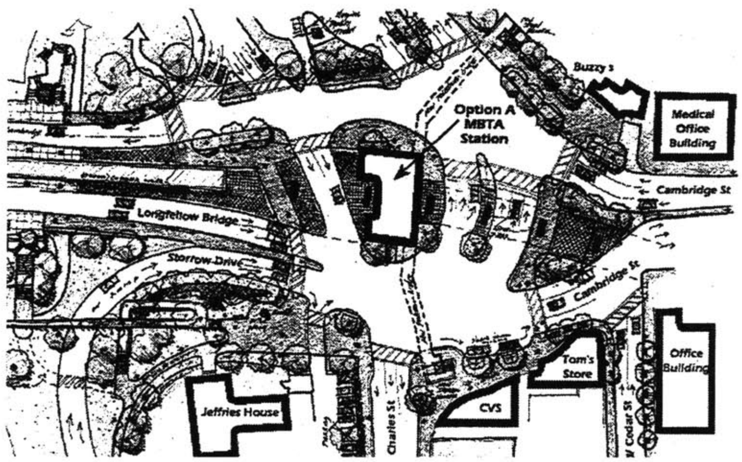

Figure 3.5
Preferred Option A

Rehabilitated headhouse at existing location with new pedestrian bridges

• ***Options B: New headhouse at easterly traffic island.*** Nine options were studied that constructed a new headhouse on the traffic island at the east end of the circle, either with its current proportions or enlarged to accommodate a larger headhouse. Of these, the preferred option includes the larger headhouse on an enlarged traffic island with at-grade access (see Figure 3.6). Enlargement of the traffic island involves reconfiguration of the intersection which allows at-grade access to the station to also match the desire lines of pedestrians crossing from one side of the Circle to the other. The enlarged island also provides for more generous space for pedestrian circulation. The inconvenience of pedestrian bridges or tunnels, as described previously, made the options including them less attractive than at-grade options. Unlike the existing headhouse location, one at the easterly traffic island allows for a protected at-grade crossing while maintaining current traffic flows.

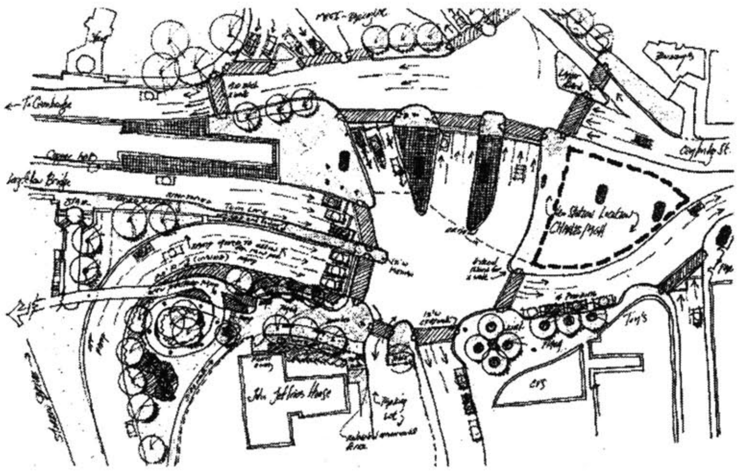

Figure 3.6
Preferred Option B

New headhouse at enlarged easterly traffic island with at-grade access

• ***Options C: New headhouse at West Cedar Street and Lindall Place.*** Three options explored placing the headhouse out of Charles Circle and integrating it with development along the south side of Cambridge Street, with at-grade, underground and aboveground connections to the north side of the street. Of these, at-grade access with an optional pedestrian bridge across Cambridge Street is preferred (see Figure 3.7). The "C" options, while removing pedestrians from the middle of the circle, addresses their desire lines poorly. Furthermore, the station platforms must remain in their current position, so that a 90 m (300 ft) walk back is required for those originating from Charles Street. This out-of-direction travel would be a significant imposition on access to the station.

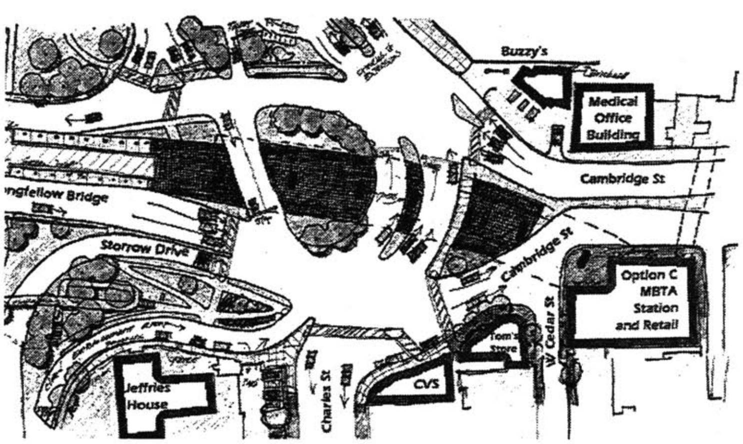

Figure 3.7
Preferred Option C

New headhouse at West Cedar Street and Lindall Place with at-grade access

After evaluation of the best option for each location A, B, and C, and the gathering of input from the community at two public meetings, the joint venture team recommended the preferred option B, a new headhouse on an enlarged Cambridge Street island with access exclusively at-grade. This option was chosen and received overwhelming support because of "its simplicity and its opportunity to create a more pedestrian-friendly environment in and around the Charles/MGH Station."[2] Plans call for completion of the new headhouse by the end of 2003.

3.2.4 Applications to Other Transit Stations

Although it cannot yet be known how effectively the recommended option will function, the process of evaluating alternatives, using the input of current users and members of the surrounding community, offers insights that can help guide efforts to improving pedestrian access to other transit stations. These insights are reviewed below.

- *The importance of well-defined station elements.* One of the current station's many shortcomings is its nondescript, unattractive appearance: it does not invite the use of the transit system. In its isolated position, marooned in the middle of Charles Circle, it relates poorly to the many surrounding destinations. While solutions sought to integrate the station better with the neighborhood, they also wanted to create a "gateway" for passengers arriving in Boston from points west. Both objectives are met with the recommended option, bringing the headhouse closer to development on Cambridge Street while providing a strong visual conclusion to the confluence of river, bridge, and city. This greatly improves pedestrian understanding of the station and invites increased ridership.

- *The desirability of direct, at-grade access routes to stations.* Alternatives at each location tested at-grade, underground, and aboveground connections. The latter two were consistently found unfavorable, except in limited cases where a protected at-grade crosswalk could not be accommodated. Pedestrian tunnels and bridges are expensive, difficult to maintain, and compromise many users' sense of security. At Charles/MGH Station, underground passageways would have to lie 10.7 m (35 ft) below street level to

[2] Elkus/Manfredi Architects, Ltd. – HDR 2000, 63

avoid utility lines.[3] Movements down to this level, back up to street level, and then up to the station platforms would be very cumbersome. The existing pedestrian bridges are no more convenient. While those destined for the station must already change levels due to its elevated position, at-grade access also serves non-station-bound pedestrians as well. An intervention that improves the overall walkability of a station area will be more successful than one that focuses only on the needs of the transit rider, as they will be more frequently used. The recommended option accomplishes this by making routes to the station and desire lines between the north and south sides of Charles Circle coincident.

- *A balance between vehicular and pedestrian needs must be struck.* Pedestrian access to most stations in compromised locations is often poor due to the impact of automobile traffic, and Charles/MGH station is no exception in this regard. By redesigning Charles Circle, traffic flow as well as pedestrian needs can be met. The current configuration is most limited by a tendency for back-ups to occur exiting Storrow Drive eastbound. The recommended option introduces a third lane to help prevent this. While this would increase pedestrian crossing distances, it allows for an exclusive pedestrian phase, which current signal timing does not allow. The current layout also does not define traffic lanes or pedestrian space very well. In the recommended option, generous space for right turns from Charles Street to Cambridge Street and a driveway on the west side of Charles Street become attractive plazas that increase pedestrian circulation space and forge a more direct connection to the Esplanade and the rest of the Charles River Basin. Similar efforts to reclaim stretches of asphalt where appropriate and demarcate pedestrian space with crosswalks, curb cuts and signals belong to any strategy to improve pedestrian access to transit stations.

[3] Elkus/Manfredi Architects, Ltd. – HDR 2000, 32

3.3 Inner Suburban Stations: Southwest Corridor Light Rail

3.3.1 System Context

The southern side of booming metropolitan Denver has led the region in growth, with Arapahoe County one of the country's fastest growing through the 1980s and its southern neighbor, Douglas County, leading the nation during the 1990s. Commuter traffic has made I-25, heading southeast from Downtown Denver, the area's heaviest trafficked corridor. In the southwestern direction, there is only a state highway, CO-85/Santa Fe Drive. Expansion and grade separations have been undertaken to accommodate the growth in traffic in this corridor, but congestion has grown unabated. As plans took shape for a metropolitan rapid transit system in the mid-1980s, the Sante Fe Drive/Southwest Corridor was among those identified for service. When a private initiative moved forward to study the I-25/Southeast Corridor, the Southwest Corridor received the public effort's highest priority. This is not only because of the high volumes of traffic in the corridor, but also because it contained an existing railroad that could possibly accommodate transit service.

Studies recommended that light rail technology be used in the corridor. Because the existing railroad is the backbone of Colorado's freight railroad system, connecting Denver with Colorado Springs, it was not possible to use the same tracks for transit service. However, a relatively generous right-of-way allowed for the construction of additional tracks for light rail within the railroad's alignment envelope. The light rail line could then take advantage of the grade separations already existing in the corridor to achieve higher operating speeds and minimize at-grade conflicts with automobiles. The disadvantage to this, however, is that the freight rail tracks as well as busy Santa Fe Drive would separate the light rail line from surrounding neighborhoods and activity centers.

The Southwest Light Rail line opened for service in July 2000 as an extension of RTD's[4] Central Light Rail line that had connected a terminal in south central Denver with downtown Denver and the Five Points district to the northeast. The line traverses the inner suburbs of Englewood and Sheridan to terminate in Littleton (see Figure 3.8). The line's success as a park-and-ride commuter line has been proven during its first few months of service in the summer of 2000. Weekday boardings amount to 28,000, twenty-five percent more than the projected 22,400.[5] This has been evidenced by the parking problems that have materialized at each of its stations. Much effort and concern has been spent since opening day in monitoring use of the park-and-rides and providing additional capacity, while pedestrian access remains challenging.

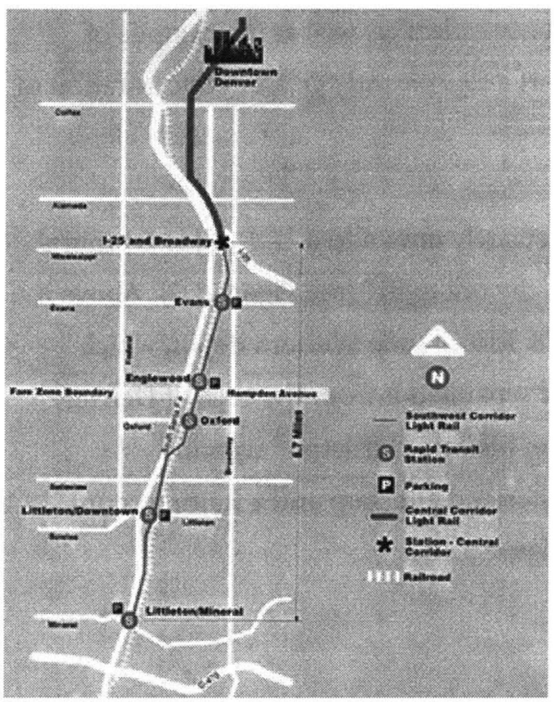

Figure 3.8 ***Southwest Light Rail Line***
Denver, Englewood, Sheridan, and Littleton, Colorado

With significant provision of park-and-ride lots and a reconfiguration of bus routes, the line serves a large area of the booming suburban "greenfield" development in the cities of Littleton and Centennial and surrounding areas of unincorporated Jefferson, Douglas, and Arapahoe counties. With the exception of the line's terminal, however, all of the

[4] RTD = Regional Transportation District
[5] Transit Alliance 2000

stations are located at "greyfield" sites challenged by demographic change and/or disinvestment. Accommodations for walk-up access to the new stations can offer lessons for efforts to improving pedestrian access at other transit stations, particularly those in inner suburbs facing similar challenges.

3.3.2 Littleton/Downtown Station

Littleton/Downtown Station serves downtown Littleton near the location where passenger trains used to call at the town. Having been eclipsed by the dominance of downtown Denver and the preeminence of shopping malls nearby, downtown Littleton is no longer a "central business district" for the city. It remains viable as an eclectic collection of art galleries and gift shops anchored by city and county offices[6] as well as the campus of Arapahoe Community College, but could support a significantly greater concentration of activity.

Light rail riders alighting at the station are immediately drawn to a 12.5 m (41 ft) mural depicting Littleton's history in the style of a "patchwork quilt" (see Figure 3.9). Above it stands the relocated and restored 1870s Denver & Rio Grande Western depot, which began serving Littleton when ten miles of prairie separated it from the edge of Denver, now a continuous urban area. The depot bears an historic "Littleton" sign and incorporates a privately owned and operated coffee and gift shop and a waiting room inspired by railroad stations of yesteryear (see Figure 3.10).

[6] Littleton is the seat of Arapahoe County

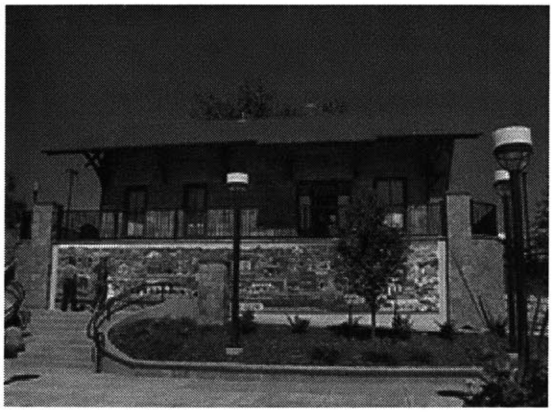

Figure 3.9

Mural depicting Littleton through the seasons faces the station at the rear of the historic depot

Figure 3.10

The restored depot faces Downtown Littleton, welcoming pedestrians with a waiting room and shop

Given the walkable conditions created by the small blocks and low-trafficked streets of Downtown Littleton, designing this station to meet the needs of the pedestrian would seem to be straightforward. However, a parking lot for 261 vehicles is literally in the way. A walkway provides a straightforward route heading north from the station to Alamo Avenue (Figure 3.11) where a crosswalk provides access to Bega Park on the opposite side (Figure 3.12). Directly next to the park is a new mixed-use development including the Main Street Apartments (fifty residential units) and 743 m^2 (8,000 ft^2) of retail.[7]

The connection south to bus bays is also straightforward for the pedestrian. A ramp heads up from the station, which lies in a depressed cut (Figure 3.13), to an attractive bridge over an irrigation canal (Figure 3.14). The bus loop itself is decidedly less attractive, but the way for those continuing their walk past the bus bays to Prince Street is nonetheless clear and direct: the campus of Arapahoe Community College on the west and a residential neighborhood on the east are readily apparent.

[7] RTD 2000

Figure 3.11

The route north from the station to Alamo Avenue is clearly marked through the use of colored concrete

Figure 3.12

At Alamo Avenue, the walkway is met directly by a crosswalk leading to a park and a new mixed-use development

Figure 3.13

The route south from the station to a bus loop and Prince Street is marked by decorative posts

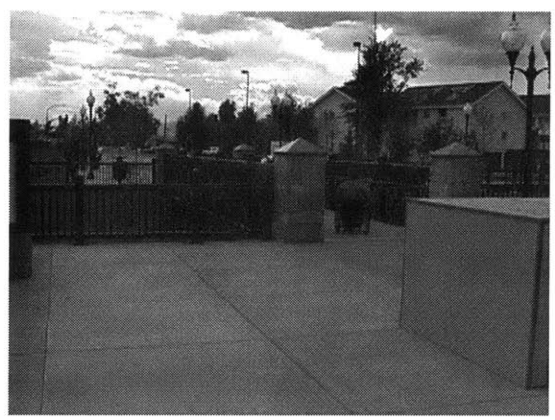

Figure 3.14

The route continues over a bridge matching pedestrian desire lines, reducing walking distances

The situation is entirely different for pedestrians headed directly west from the station. The entrance to the park-and-ride from Prince Street, one of Littleton's main north-south axes, is here. The Art and Design Center of Arapahoe Community College stands opposite, flush with the sidewalk, but the only way to walk there from the station is by walking through the "car space" of the parking lot (see Figures 3.15 and 3.16).

Figure 3.15

The route west from the station to Prince Street puts pedestrians in the park-and-ride's driveway

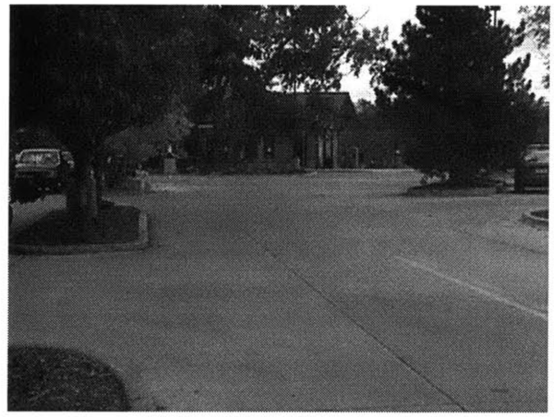

Figure 3.16

The view east from Prince Street toward the depot shows the glaring lack of a sidewalk that could easily be accommodated

3.3.3 Oxford Station

Perhaps more than any of the other Southwest Corridor light rail stations, Oxford Station demonstrates the problems of pedestrian access in a freight railroad and highway corridor. Though it is "intended as a neighborhood station without parking," there are significant barriers between it and nearby neighborhoods.[8] Figure 3.17 shows the wide expanse of railroad tracks along the west side of the station, which are in turn paralleled by busy Santa Fe Drive (CO-85) on the other side. The only way to reach the neighborhoods of Sheridan on the other side is to walk about a block south from the station entrance to Oxford Avenue, under the railroad tracks and finally across the highway. The neighborhoods of Englewood on the east side of the station are easier to reach, but warehousing and lack of sidewalks outside of the immediate station area are an impediment to walking (see Figure 3.18).

[8] RTD 2000

Figure 3.17

Freight railroad tracks west of the station create a barrier to access

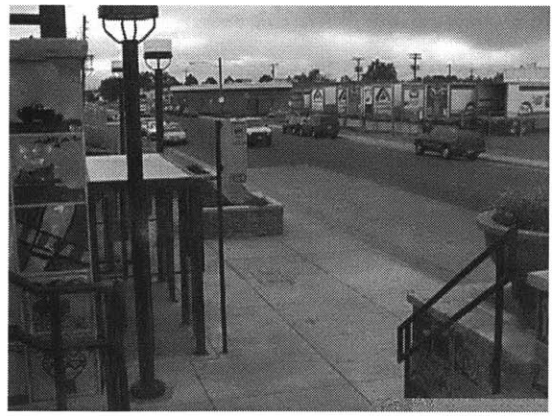

Figure 3.18

The uses and lack of amenities opposite the station do not encourage walking

Indicative of the lack of sufficient pedestrian facilities are the parking problems that have arisen at the station since the line opened. Light rail patrons have overloaded local on-street parking, and as a corrective measure, RTD has rented 100 spaces at a lot on the west side of Santa Fe Drive. However, getting across the highway and under the railroad tracks is quite an obstacle course and only "about 10 of [these] spaces get used on a regular basis."[9] Apparently the poor pedestrian environment in this station area even discourages those arriving by automobile. These dissatisfying conditions are ameliorated somewhat by the colorful mosaic adorning the retaining walls of the station and its entrance stairway and ramp. The individual tiles (visible on the left side of Figure 3.18) illustrating transportation themes, were handpainted by hundreds of area schoolchildren.

3.3.4 Englewood Station

In contrast to Oxford Station, the next stop along the Southwest Corridor, Englewood Station, provides much better accommodations for pedestrians. Like Littleton/Downtown Station, it is not located next to a major arterial, but rather nearer to activity centers and neighborhoods. The station actually borders a 22 ha (55 acre) redevelopment site allowing

[9] Munds 2000, 10

the existing central business district of Englewood, several blocks to the east, and a residential neighborhood to the north to "reach out" and include the station. The redevelopment promises to encourage walk-up access to the station from these established areas while creating a base of transit riders among the new residents who will live next door.

"CityCenter Englewood", as the redevelopment project is called, replaces Cinderella City, the premier shopping mall in the region and one of the largest in the country when it opened in the late 1960s. In the 1980s, new malls in nearby suburban areas drew shoppers away until few of the hundreds of stores remained in business in the early 1990s. The huge structure was recently demolished; however, the shell of one of the department store anchors has been reused and is now the Englewood Civic Center, housing city offices, a library, museum, and other public facilities. Englewood Station is located opposite a public "piazza" from the Civic Center. Because the light rail tracks are on an embankment, a dramatic pedestrian bridge allows riders to cross over the bus loop serving the station and brings them directly to the piazza (see Figures 3.19 and 3.20).

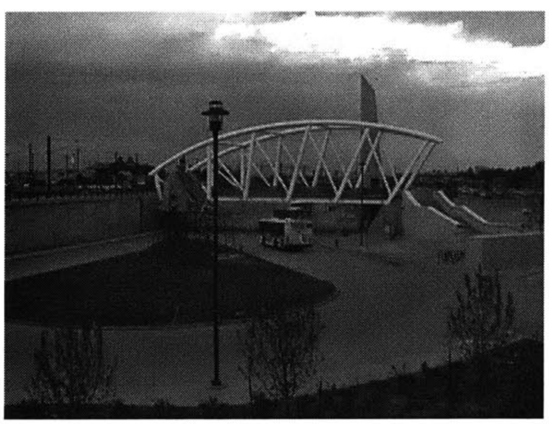

Figure 3.19

Pedestrian bridge connects platforms directly to piazza and civic center

Figure 3.20

The bridge acts as a gateway to the city and emphasizes the proximity of transit service

The piazza is currently surrounded by empty lots but will soon become the centerpiece of an "urban village" including 291 residential units, 30,650 m^2 (330,000 ft^2) of retail, 13,900

m^2 (150,000 ft^2) of office space, and 4,600 m^2 (50,000 ft^2) of restaurants.[10] The architects of the project claim that the design of the intervening pedestrian plazas and streets will include "carefully orchestrated public processional, performance and gathering spaces." Figure 3.21 shows the site plan, and Figure 3.22 a model of the station, bus bays, and Civic Center (now complete, see Figure 3.23) as well as the complete piazza and residential/retail complex (currently under development).

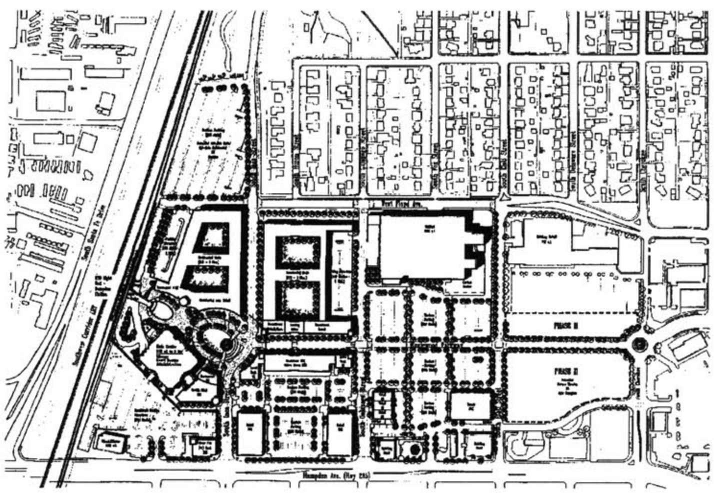

Figure 3.21
Englewood CityCenter site plan

Station is at far left, at left end of axis created by piazza and Englewood Parkway; Inca Street runs on the right side of the parking lot (left, top) through the redevelopment site

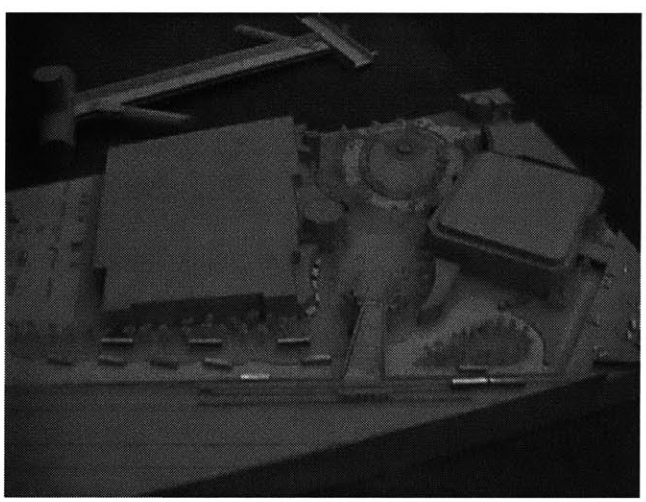

Figure 3.22

Model of CityCenter Englewood at completion clockwise from top, center: piazza, Civic Center, light rail station with bus loop, retail uses with residential above

Figure 3.23

Englewood Civic Center (left) occupies shell of former department store; bridge linking to station clearly visible at right

[10] David Owen Tryba Architects

A large component of the redevelopment includes retail uses, and so at first glance it might appear that these are doomed to fail and suffer the same fate as the shops in the defunct mall. However, the City of Englewood commissioned a careful study of what its residents wanted for the site and what would be supported by market demand. As a result of this process, specialty entertainment-retail uses, a hotel and a performing arts center were ruled out while a variety of standard retail uses, theaters and restaurants are expected to do well at the site. Transit-oriented development purists might object to the presence of Wal-Mart in the mix of uses in the redevelopment plan (see Figure 3.21; the store occupies the block in the center of the plan). Such "big box" retailers and their attendant parking lots can have a stymieing effect on the pedestrian environment. Although the store is set back from the street by its parking lot, the parking is overlaid by a grid of landscaped pedestrian paths that could facilitate future infill. Additionally, it is located on the edge of the redevelopment where it will have less of an impact on internal pedestrian circulation (though interfering with the connectivity of the redevelopment with its surroundings). Finally, though its design could have been better, a discount retailer meets a neighborhood need and is a great benefit to the cost-conscious, lower income residents of the area who may not have access to an automobile.

The grand plans for Englewood Station are not without some concerns. First, the station is popular among park-and-riders, who fill the 910 spaces at the parking lot just north of the station. Light rail riders are also filling up the parking lot at a city park further to the north. To access the lots, motorists must use Inca Street, the north-south axis of the redevelopment's core, or Floyd Avenue, which separates CityCenter from an established neighborhood of single-family homes. Additional traffic on either of these streets could discourage walking by dividing the redevelopment and separating it from the neighborhood. Furthermore, the area west of the railroad tracks and Santa Fe Drive is quite inaccessible from the station. Pedestrians wishing to reach it must walk a considerable distance along the tracks on one side and a parking lot on the other to reach Hampden Avenue (US-285), a busy highway. As at Oxford Station, one must then walk under the railroad tracks and across Santa Fe Drive, hardly a pleasant option. Another option is to walk north to reach the underpass at Dartmouth Avenue—a distance of over two blocks—but this also requires an unattractive passage along the park-and-ride lot. It is disappointing that no attempt has been made to connect the new "city center" with the neighborhood to its west. At present, the light rail station lies at the very edge of activity.

3.3.5 Applications to Other Transit Stations

Although it has an operating history of less than one year, the Southwest Corridor light rail line offers some lessons for improving pedestrian access at transit stations of other rapid transit lines. These are especially applicable to inner suburban sites, where redevelopment, as at Englewood Station, or intensification of development, as at Littleton/Downtown Station, is desired.

At the station itself, public art and distinctive architecture help improve the pedestrian environment, but are no substitute for direct and convenient routes of access.

- Artwork and landscaping at Oxford Station enhance the attractiveness of the route patrons take to and from light rail, but they are limited to the immediate station area and are not sufficient to encourage motorists to use more distant parking opportunities.
- The pedestrian environment is much improved at Littleton/Downtown Station by the historic depot. The vice-president of the Littleton Downtown Board of Directors, Andy Marquez, remarks, "there is a new feeling in this town that I haven't felt before. It's very contagious. Without question the Light Rail Depot is an ace in the hole. It's extremely charming and sets a real welcoming mood for anyone living in or visiting Littleton for the first time." While not every transit station can incorporate an historic building, the public's excitement and acceptance of the depot suggest that a unique structure incorporating amenities for transit riders can ameliorate the pedestrian-deadening setting of station parking lots. These can of themselves generate foot traffic to and from the station, reinforcing pedestrian access and resulting in much better integration of transit with the community around it.

- The pedestrian bridge at Englewood Station is a prominent landmark that will enjoy direct lines of sight from the completed public piazza, encouraging transit use. However, the bridge's role in providing a convenient connection to the station along pedestrian desire lines is even more important than its function as a station identifier.

Beyond the station, connective elements foster pedestrian access.

- At Littleton/Downtown Station, a pathway established through the park-and-ride lot connects directly to a crosswalk leading to points north of the station. The pathway is well defined by landscaping and a treatment different from the surrounding pavement.
- At Englewood Station, the grid of the established neighborhood nearby is continued through the redevelopment property to meet the station. This provides multiple paths for pedestrians and helps to integrate the new retail and residential units with existing development. The park-and-ride lot is placed off to the side of the station where it has the least impact on pedestrian routes. Perhaps the most promising aspect of the redevelopment plans is the design of the piazza fronting the station. Connecting the station, at the very edge of the site, with the intersection of the north-south axis (Inca Street) and west-east axis (Englewood Parkway) of the emerging "city center", the piazza effectively allows the station to reach its very heart. Due to the site's grid of streets, any point within it is within sight of the two axes that lead directly to the piazza—and thus, to the station. Due to this effect, perceived walking distances to the station are likely to be less than they really are and encourage a larger pedestrian catchment area than would otherwise be the case.

3.4 Outer Suburban Stations: Westside MAX

3.4.1 System Context

Portland, Oregon, has enjoyed wide acclaim in recent years as an example of the best practices in contemporary urban and transit planning. A number of unique conditions provide the context for these progressive policies and designs: a population with an unusually high environmental ethic; the nation's only elected regional government; and an urban growth boundary coupled with guidelines for focusing development in specific areas. Plans for an intrusive freeway funneling traffic out of downtown Portland to the east was the impetus for planning one of the nation's first modern light rail systems, dubbed MAX (Metropolitan Area Express). The Banfield Corridor light rail line, or Eastside MAX, was built instead of the freeway, linking the city with Gresham on the metropolitan area's east side in 1986. Similarly, plans for an outer beltway around the western side through rapidly-growing Washington County were also questioned.

3.4.2 Transit in Greenfields as an Armature for Growth

Through the modeling and planning process dubbed LUTRAQ, the need for the beltway was refuted and instead a western extension of the initial light rail line was conceived. More than any other U.S. rail project in recent times, this line was designed to shape development patterns and provide a framework around which more pedestrian-friendly and less automobile-oriented growth could occur. While a generation must pass before the full effects of this "experiment", more carefully orchestrated and on a grander scale than perhaps anywhere in the country, can fully be understood, the droves of new homeowners and high-tech employees in Washington County are already enjoying a level of pedestrian orientation and transit accessibility unusual in American suburbia.

The opportunity to use a new transit line to focus development was based in part on a clear relationship between proximity to transit and property values. Research on housing prices along the original, eastside light rail line suggests a significant willingness among homeowners to pay more to be close to a station. This is underscored by the fact that the line traverses an area mainly residential in nature. The light rail corridor has little in the way of major employment or activity centers that would be additional factors to explain higher housing values. A study of sales figures from the two-year period between 1992 and 1994, more than five years after light rail service began, estimates a "$32 decrease in sales price per meter as one moved away from [a] station." A ten percent drop in price was observed at a distance of 1,400 meters, approaching the outer limits of a station's pedestrian catchment area.[11]

In anticipation of the 1998 opening of the westside line, contemporary research looked at land value increases around its alignment between 1991 and 1994. Within a half-mile of each future station location, property values did increase with proximity to the station. While this suggests a premium for walkable proximity as in the eastside study, this research did find, however, that the distance to downtown Portland played a more significant role than proximity to the future transit line.[12] This is not surprising, given that half of the region's office space is located in Portland's CBD, quite a large share in comparison with other U.S. cities. The westside line, then only in planning, now provides a direct connection to downtown Portland, giving motorists an alternative to the few bottlenecked arterials that traverse the West Hills that separate Portland from Washington County. Due to this, it can be readily expected that proximity to the transit line and its direct service to downtown Portland has become much more significant as compared with distance from downtown now that the line is operational.

The aforementioned LUTRAQ study predicted that a closer fit between transportation and land use decisions would help reduce driving. A travel behavior study conducted in 1994 found that 28 percent of all trips in the mixed-use older neighborhoods of Portland are made on foot, while only 5 percent are walk trips in the region's newer suburban areas. LUTRAQ recommended that the pedestrian-supportive environments of these older neighborhoods be replicated in new developments in Washington County, clustered around new MAX stations. The emergence in the late 1980s and early 1990s of the idea of "pedestrian pockets" and "traditional neighborhood development" (TND) provided models for this. "Pedestrian pockets" place precincts of pedestrian-friendly development at transit stations, while TND intends to replicate older neighborhoods and their pedestrian-friendly qualities. In an early critique, Atash finds many similarities between the two, but identifies the pedestrian pocket's inherent transit stop as a distinguishing

[11] Dunphy 1998, 4
[12] Dunphy 1998, 5-6

element. He finds that it has much greater potential for changing travel behavior because the linking function of the transit line allows for the possibility of effects on a metropolitan scale. Additionally, he suggests that public sector intervention—in identifying locations for pedestrian pockets—would further increase the potential effects.[13] This is precisely what was done in Washington County, as sites along the light rail extension were identified in the metropolitan government's Metro 2040 plan for focused, transit-oriented development (TOD), as the "pedestrian pocket" is now more popularly known. One of these was the former site of the Oregon Nursery Company, which shipped its produce on the railroad that has become Westside MAX. Plans called for a 190-acre community served by a light rail station and anchored by a mixed-use "Main Street". The importance of the transit station to the development is reflected in its name, "Orenco Station", which also recalls the old nursery.

3.4.3 Challenges to Pedestrian-Friendly Design: Orenco/NW 231st Station

Despite the site's greenfield condition and all of the good LUTRAQ intentions, challenges to achieving good pedestrian access to the station emerged. The realities of retail viability led to siting the project's core at Cornell Road, a full quarter-mile north of the light rail station. Because the center was to draw shoppers from outside the development, this major arterial and its 40,000 trips a day could not be ignored. This, of course, "makes walking to the light rail station [more] difficult" from the new homes on the opposite side of the road from the station.[14] The station's park-and-ride, however, was reconfigured so that pedestrians could have a direct, bee-line connection to the project's mixed-use center, the "Main Street" on Orenco Station Parkway. The parking lot is set to one side, still convenient to the station, but putting the pedestrian axis along Orenco Station Parkway to Cornell Road first (see Figure 3.24). Using CMAQ funds, this route was reinforced with enhanced pavers, wider-than-normal sidewalks, and traditional light fixtures. Currently, the walk provides little interest or activity and leaves one quite exposed, as the planned commercial and residential projects along the Parkway south of

[13] Atash 1994, 53, 55
[14] Hock 2000, 22

Cornell Road have yet to be developed. However, if plans for the south side materialize as they have on the north, an attractive, if not especially short walk to the station will one day be reality.

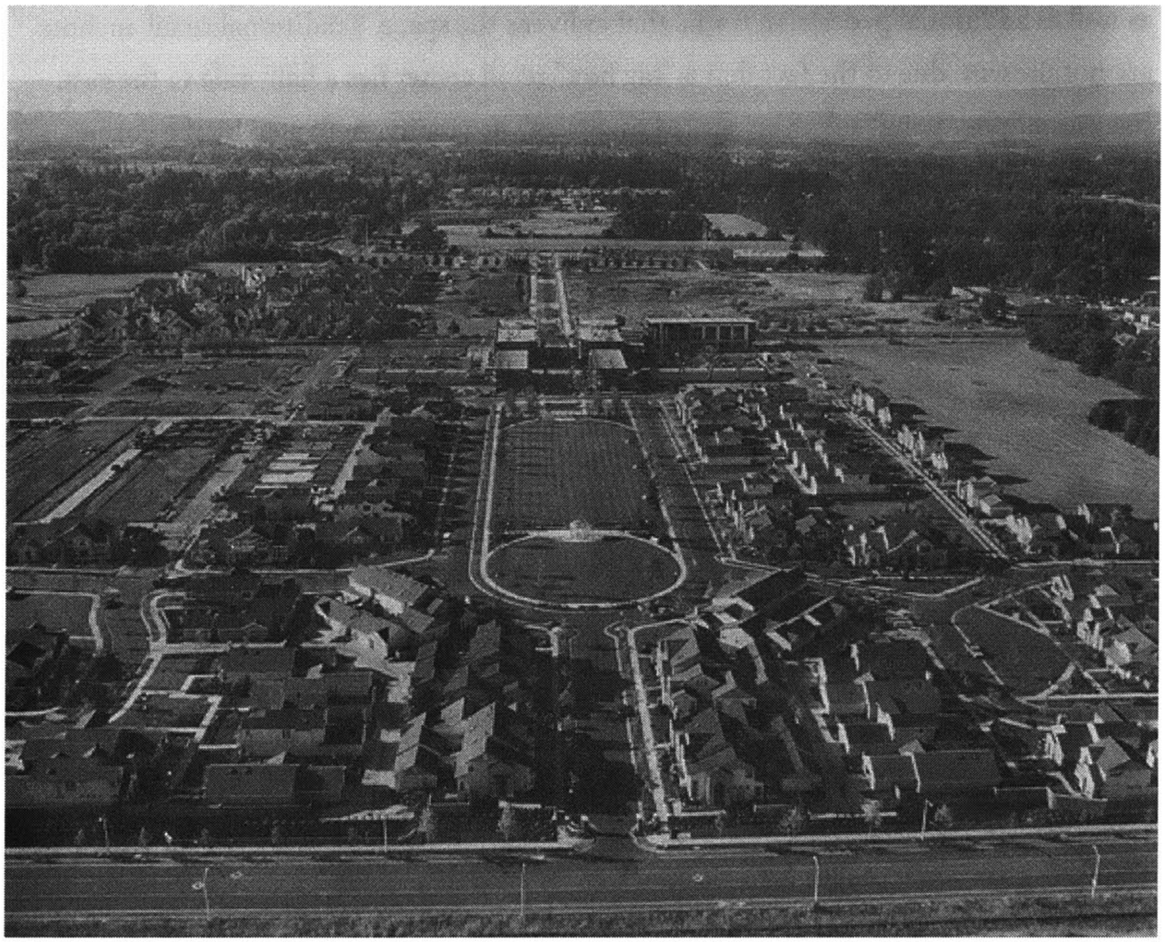

Figure 3.24 ***Orenco Station***
Hillsboro, Oregon

The park (center), around which residential development is oriented, terminates Orenco Station Parkway on the north; the parkway functions the town center's "Main Street", crosses Cornell Road (running from left to right, top center), and terminates at the light rail station (top)

For Orenco Station's suburban location, the number and quality of pedestrian amenities are impressive: on-street parking and bollards define the pedestrian space on 4.9 m (16 ft) wide sidewalks, traditional fixtures provide ample lighting, street furniture offers places to rest and linger, and shops with brick façades line the street. Residences or offices above in the three-story buildings with prominent cornices, bay windows, and balconies frame the street (see Figure 3.25).[15] The north end of this "Main Street" block bordering a park is lined with live/work units where residents have already opened offices in the lower levels (see Figure 3.26). This flexibility means that activity and interest are brought to the street, as well as additional pedestrian traffic that enlivens the space. Traditional retail anchors are not present, due to the fact that a "big box" retail center lies a half-mile to the east. Instead, a "ping pong" effect brings "Main Street" its vitality. Activated by the corner Starbucks coffee shop, attention springs across the street to another shop, then back to the other side to another and so on.

Figure 3.25

View north on Orenco Station Parkway at Cornell Road

Figure 3.26

North end of Orenco Station Parkway at park

The developers and designers of the project maintain that the "Main Street" is more of a selling factor than the proximity to transit, citing a 20 percent increase in property values because of it.[16] This is certainly higher than the figures for transit proximity-based housing/property values from the aforementioned broader-based corridor studies. The higher values apply to the wide range of housing types available, including accessory units, live/work lofts, townhomes as well as single-family homes on compact lots. This is one indication that a community encouraging more walking has been achieved. While the southern stretch of Orenco Station Parkway remains to be similarly outfitted, it is

[15] O'Neill 1999, 6
[16] Boileau 2000

3.5 Conclusion

Though situated in very different contexts, the case study stations demonstrate that access to stations in pedestrian-unfriendly environments can be improved. The challenges, whether in urban or more suburban settings, involve encouraging more pedestrian-friendly orientation in the design of development and in reducing the impact of traffic and automobile-related facilities. This is achieved through similar strategies:

- *improving the visibility of stations and integrating them with their surroundings*, which is accomplished by the unique pedestrian bridge and piazza at Englewood Station and is the motivation behind the planned headhouse relocation at Charles/MGH Station;

- *providing more direct routes*, which the pedestrian promenade to Orenco/NW 231st Station creates and an at-grade entrance to Charles/MGH Station would achieve;

- *and balancing the needs of pedestrians and motorists*, which a walkway through the park-and-ride lot at Littleton/Downtown Station does and is what a protected pedestrian crossing at Charles/MGH Station would accomplish.

These factors, such as visibility and directness, are examined in detail in the following chapter where a systematic analysis of the range of factors that influence pedestrian access to stations is undertaken. The means of analysis developed through the case studies in this chapter helps to apply lessons learned from stations where pedestrian access has been studied or improved, as well as the literature on pedestrian behavior in general, to reach specific guidelines.

reasonable to conclude that many walk trips from the homes north of "Main Street" to the light rail station are induced in part by an interesting and comfortable experience and an opportunity to take care of business and make small purchases on the way.

3.4.4 Applications to Other Transit Stations

Many of the Westside MAX stations are in "greenfield" locations surrounded by new development or undeveloped land. The compromises to pedestrian access at stations in more developed areas would seem to be avoided, given such a "clean slate" as a context. Nonetheless, Orenco/NW 231st Station demonstrates that there are still compromises: a need to accommodate the needs of motorists and issues of project phasing and timing. How Orenco Station's developers addressed these issues offer lessons for other station areas, especially those in "greenfield" locations.

- *Putting pedestrian needs first.* The town center of the Orenco Station development was placed at an arterial instead of at the station in order to assure its viability. Though this increased walking distances, pedestrian needs were met by creating a clear and direct route from the station to the town center, where parking is placed behind buildings. The station park-and-ride was sited at a location offset from pedestrian desire lines, reinforcing a pedestrian-oriented axis well defined within the town center.

- *Planning ahead for the "big picture".* Though zoned to complement the new Orenco Station development north of Cornell Road, the parcels south of the road and nearest to the station remain undeveloped. This reflects the fact that property in station areas is typically held by many owners, and projects undergo different schedules of planning, financing, and construction. If adjacent projects are not coordinated, pedestrian routes may not be adequately implemented. By pursuing the improvements along Orenco Station Parkway connecting the town center with the light rail station, an attractive route through future development is already in place. This, along with the precedent of pedestrian-oriented design in the town center to the north, increases the likelihood that the future development will address pedestrian needs as well.

Chapter Four
FACTORS INFLUENCING PEDESTRIAN ACCESS

4.1 Evaluation Methodology

The case studies presented in the previous chapter illustrate some of the considerations involved in planning station areas for pedestrian access. Site visits and review of planning efforts at a handful of stations may uncover many of the qualities that influence walking as an access mode, but cannot encompass the full range of possible factors. To develop this broader range, the literature on pedestrian behavior has been consulted. Findings from this literature review, along with experiences surveyed and studied at transit stations around the country, comprise this chapter. While not claiming to be an exhaustive treatment of every possible factor influencing pedestrian access to stations, the important issues are presented in the following sections in some of detail.

These important factors have been culled largely from two sources: the *Portland Pedestrian Design Guide* and the San Francisco Travel Demand Model. Both identify "pedestrian environmental factors" (PEFs) deemed to influence walking as a transportation mode. In Portland, the model had four variables: ease of street crossings, sidewalk continuity, local street connections, and topography.[1] In the San Francisco model, five were used: network continuity/integrity, ease of street crossing, perception of safety and personal security, urban vitality, and topological barriers.[2] While neither a discussion of how the PEFs were determined nor a weighting scheme to assess the relative importance of individual factors is offered by these sources, the PEFs are used in the guide and model as composites to rate a "level of service" for pedestrians. Higher PEF scores for streets or neighborhoods, for example, mean that they are more pedestrian-friendly. Lower scores denote poor walking conditions. As evidence that the PEFs are an accurate measure of walkability, it was found that areas in Portland with high PEF scores had four

[1] Calthorpe and Fulton 2001, 112
[2] Castiglione and Decker 1999

times the rate of walking and biking than those with low PEF scores.[3] When household sizes and incomes were held constant, the quality of the pedestrian environment "still showed a significant effect."[4] In a separate study undertaken in Portland, detailed travel diaries showed that people in walkable environments, as measured by an "urban index", used automobiles at a third of the level as those in pedestrian-unfriendly environments.[5]

The "urban index" and PEFs used in Portland and San Francisco are for the most part broadly applicable to any urban environment. One exception is the use of topography, which is an important factor influencing pedestrian travel in San Francisco and Portland, but may or may not be in other urban areas, and is thus excluded from this analysis. Other factors not explicitly included in the Portland and San Francisco models but appearing frequently in the literature on pedestrian travel were added. Still others that are not given great emphasis in the literature on pedestrian travel in general but are important to the specific case of walking to stations (e.g., station identification) were included as well. A master list was then distilled and grouped into six general areas of similar factors. They are as follows:

- Directness of Pedestrian Routes
- Continuity and Integrity of Pedestrian Routes
- Ease of Crossing Streets
- Perception of Safety and Security
- Provision of Identification and Information
- Urban Vitality

The sections to follow describe each of these groups of factors in detail, providing evidence to generate guidelines for improving pedestrian access to transit stations. These guidelines are in the form of specific questions to be used in the evaluation of station areas.

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[3] POTED 1998, *Portland Pedestrian Design Guide*
[4] Calthorpe and Fulton 2001, 112
[5] Calthorpe and Fulton 2001, 70

4.2 Directness of Pedestrian Routes

Direct routes of access greatly facilitate walking to transit stations. Given an "area of influence" of one-half kilometer radius (one-third of a mile) around a station, attracting 100 percent of the trips originating within the defined area theoretically would mean that each pedestrian on the perimeter would have a "beeline", direct route. In practice, of course, most pedestrians will have to take a number of turns, including some out-of-direction travel, on their way to a station. A walk of half a kilometer to a station, then, is likely to originate well within the "area of influence", not from its edge. A significant component of encouraging more walk-up access—or, in other words, spreading the number of walk trips to approach 100 percent of the origins within the half-kilometer radius described—involves increasing the directness of the pedestrian routes leading to the station.

4.2.1 Direct Sidewalks and Pedestrian Routes

Recent research by Virginia Sisiopiku and Darcin Akin at Michigan State University documents the proclivity of pedestrians for direct paths. Only somewhat more than a third of the pedestrians surveyed (38%) were willing to divert their travel in order to cross at a crosswalk. 42 percent indicated that they were sometimes willing to do so, while 20 percent refused to go out of their way to cross at a designated crossing location. Not surprisingly, a high percentage of those surveyed (41%) typically cross at "any convenient location." While 29 percent of the pedestrians claimed that they "rarely or never" crossed at non-designated locations, a proportion nearly as great (25%) admitted to "often or almost always" jaywalking. When questioned about why they crossed at a location other than a crosswalk, respondents cited "convenience" (42%) and "time savings" (27%).[6]

Given this strong preference for convenience, it is not surprising that the proximity of the destination to a crosswalk was a crossing choice determinant for 90 percent of those

[6] Sisiopiku and Akin 1999, 4

surveyed—a factor greater than the presence of a pedestrian signal (74%) or colored paving (58%). It is clear that physical attributes of the crossing play a secondary role, while the convenience of a direct route is the pedestrian's primary concern. Walking can be encouraged by providing designated crossings at locations where pedestrians desire them. In this vein, Sisiopiku and Akin suggest that "traffic engineers should pay extra attention to land uses that may generate increased needs for pedestrian movement and consider those needs when making decisions on placement of pedestrian crosswalks at certain locations."[7]

Crossing streets, of course, comprises only a fraction of the total walking trip. Overwhelmingly, pedestrian movements take place on sidewalks along city streets. This is not only the traditional place to walk, but also provides the most convenient access to homes and businesses, which are oriented to streets. More direct routes can often be provided by off-street trails or pedestrian-only paths. These may lead through parks or in the right-of-way of a utility or an abandoned use, sometimes a former rail line. Examples of both can be found walking east from Alewife Station. A pedestrian path through a linear park provides a direct route from Massachusetts Avenue to Alewife Station, but the lack of connections from the path to its immediate surroundings compromises its attractiveness (see Figure 4.1). Such connections, besides adding convenience and directness, provide "escape routes" should a pedestrian feel uneasy or threatened. Additionally, the fact that surrounding uses turn their backs to the path means that casual surveillance is lacking. For these reasons, off-street, pedestrian-only facilities are not always ideal. When they can provide a sufficient level of security and more direct routes, they are more likely to be successful.

[7] Sisiopiku and Akin 1999, 5

Figure 4.1 ***Linear Park near Alewife Station***
Cambridge, Massachusetts

Fencing along most of the linear park reduces connectivity to the surrounding neighborhood

One example of successful off-street pedestrian routes can be found at Prairie Crossing, a subdivision of single-family homes in Grayslake, Illinois, that includes 16 km (10 mi) of trails connecting to a commuter rail station. These homes have sold at 33 percent higher prices than comparable homes in other areas of metropolitan Chicago, which is attributed in part to this amenity.[8] In a study of pedestrian and bicycle access to the WMATA Orange Metrorail Line in northern Virginia, an off-street connection to the Washington & Old Dominion Trail (in the right-of-way of a railroad of the same name) is identified as an improvement to facilitate additional walk-up and bicycle access to the Metro stations.[9]

On the whole, off-street, pedestrian-only facilities play a subordinate role to the standard sidewalk. They are less likely to form the backbone of the pedestrian route network, but fulfill a very important role in providing short connections between the sidewalks along city streets. This is illustrated by a pedestrian-only promenade fronting a transit-oriented apartment complex and leading to the Gresham Central MAX light rail station in Gresham, Oregon. Tri-Met, the local transit authority, obtained $700,000 in CMAQ[10] funds to build this facility. The promenade is described as a "land use bridge" that effectively shortens the distance between downtown Gresham and the MAX station by several blocks.[11] Based on this success, the city is pursuing a street improvement project to

[8] O'Neill 1999, 19
[9] Neumann 1989, ii
[10] *C*ongestion *M*itigation *A*ir *Q*uality
[11] Tri-Met 1999, 9

expand the pedestrian environment throughout its downtown.[12] Off-street pedestrian paths are particularly in need when desire lines cross through large parking lots. Figures 4.2 and 4.3 illustrate how a direct pathway for pedestrians improves walking conditions.

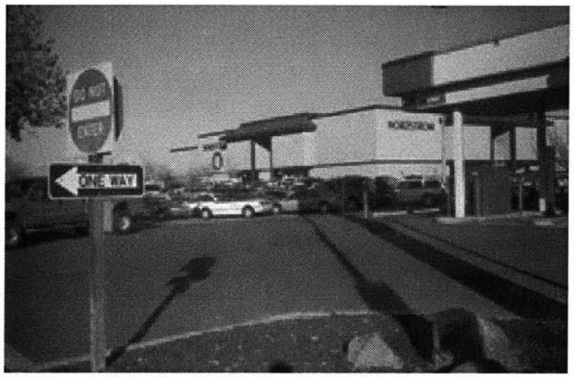


Figure 4.2 ***Fashion Place Mall***
Murray, Utah

The route from Fashion Place West TRAX Station winds through a maze of parked cars

Figure 4.3 ***Lenox Square Mall***
Atlanta, Georgia

The route from Buckhead MARTA Station is facilitated by a clear and direct promenade

Given that sidewalks are the "bread and butter" of pedestrian facilities, it follows that direct and connective street networks provide direct pedestrian routes. The "urban index" used in Portland to measure walkability quantified the frequency of street intersections as one of its two components, because it corresponds with the directness of walking routes.[13] Intuitively, a dense grid provides more direct routes than a curvilinear pattern with many cul-de-sacs. Research by Robert Cervero and Michael Bernick confirms this theory. They conducted a detailed analysis of two San Francisco Bay Area neighborhoods. Both have similar household incomes, levels of transit service, and topography. Both are also served by a BART (Bay Area Rapid Transit) station. Rockridge was initially built prior to World War II along a streetcar line and has a gridlike street pattern. Postwar Lafayette was laid out with no respect to the location of transit service. In each case, the BART station is located in the median of a freeway. In order to compare the street patterns in the two neighborhoods, the percentage of four-way intersections and the percentage of streets that

[12] Deeming 1998, 73
[13] Calthorpe and Fulton 2001, 70

end as cul-de-sacs were determined. Four-way intersections—obviously predominant in a street pattern of regular blocks—allows the pedestrian frequent opportunity to adjust her path and avoid out-of-direction travel. Dead-end streets, on the other hand, introduce circuitous routes. Around Rockridge Station, 45 percent of intersections were four-way, while only 10 percent are around Lafayette Station. Correspondingly, the proportion of dead-end streets in the Lafayette neighborhood was more than twice that found in the Rockridge neighborhood.

This has a surprisingly strong effect on the level of walking. Cervero and Bernick find much higher rates of pedestrian travel among Rockridge residents; indeed, 13 percent of them walked to shopping while none of the Lafayette residents did. Not surprisingly, a 20 percent greater proportion of walk access to Rockridge BART Station was found compared to Lafayette BART Station.[14] Rockridge does have a significantly higher residential density than does Lafayette—13.1 versus 5.2 dwelling units per hectare (5.3 vs. 2.1 d.u. per acre). Older neighborhoods with a gridded street network invariably exhibit higher densities than their postwar counterparts, and it is difficult to isolate the effect of density from the effect of street pattern. Nonetheless, the greater number of direct routes fostered by Rockridge's orthogonal pattern certainly is a factor explaining why so many more of its residents walk to BART than do Lafayette residents.

4.2.2 Direct Pedestrian Bridges and Tunnels

The directness of pedestrian routes is not only to be measured horizontally, but vertically as well. Some conditions require grade separations for pedestrian routes. In a typical heavy rail system employing a third-rail power source, walkways under or over the tracks are required. Similarly, pedestrians must be provided a grade-separated means of crossing freeways, expressways, or other limited-access, divided highways.

In some situations, rail lines or highways can be crossed at-grade. Light rail tracks are an obvious example. This is possible because light rail vehicles are usually powered by

[14] Bernick and Cervero 1997, 104, 119

overhead catenary and are manually driven. In parts of light rail alignments where high speeds are reached, however, a grade-separated crossing may be deemed necessary. In the case of other types of railroad tracks, the prevailing conditions also determine how the pedestrian crossing is treated. At Evans light rail station in Denver, Colorado, a freight rail track spur separates the platform of the station from its only entrance. Crossing gates are used there to prevent pedestrians from crossing the tracks when a freight train is approaching. The infrequency of trains using this spur and the low speed of the trains allow for this kind of solution. Conversely, the Union Pacific (UP) railroad running through Oakland, California, has higher train volumes traveling at higher speeds, which unfortunately has resulted in several pedestrian fatalities. For this reason, the pedestrian routes from Coliseum BART Station to the neighborhood to the east of it on the other side of the UP tracks are directed through tunnels.[15]

With the exception of limited-access freeways and expressways mentioned earlier, both at-grade and grade-separated solutions are possible for street crossings as well. Highways in suburban areas often have many lanes and are designed for high speeds, yet do feature crosswalks and pedestrian signals at intersections, though they may attract little use. Tunnels and underpasses, or pedestrian bridges and overpasses, are also constructed in these conditions, often near schools. However, these interventions are problematic for a number of reasons. They can be prohibitively expensive, especially when ramps or elevators are required to make such facilities accessible to all. Moreover, the pedestrian will almost certainly consider a "diversion" to a level above or below a perceived direct route an inconvenience. Even when substantial barriers are erected he is likely to cross the street at-grade anyway. Additionally, maintenance and surveillance of underpasses or overpasses can incur substantial expenses. The pedestrian tunnel originally built to serve Charles/MGH Station was shut down because it had become unsafe, as the MBTA had invested little in maintaining it. Finally, an overpass or underpass can be difficult to integrate into the streetscape. Without a sensitive design, they can obstruct views or attract graffiti and become eyesores. The overpasses over Rutherford Avenue and Prison

[15] Albert 2000

Point Bridge in Boston's Charlestown district, providing connections to MBTA's Orange Line rapid transit, were removed for this reason.

Pedestrian bridges and a tunnel at three Metrorail Stations in Montgomery County, Maryland, illustrate the failures and successes of grade-separated facilities for pedestrians. Wheaton Station provides an example of where a bridge requiring a movement up and then down again attracts little use. Rockville Station is a better example, showing how the transition between levels is disguised and made less of an imposition on pedestrians. Finally, Bethesda Station illustrates the best example, where a tunnel and two pedestrian bridges follow desire lines up and down levels, providing convenient connections between the station and its surroundings.

Montgomery County borders Washington, D.C., on the north and has exploded in population as suburban development has spread around the District of Columbia. The Metrorail Red Line forms a loop with its outer ends terminating in the county. The eastern end runs deep under Georgia Avenue, one of the county's major arteries. It is a typical suburban corridor, a commercial strip characterized by heavy traffic and large building setbacks filled with parking lots. It is within this context that Wheaton Station opened in 1990 as a temporary terminus for the line (see Figure 4.4 for overview). As such, extensive parking facilities were planned for the station, which took the form of a multi-story parking garage.

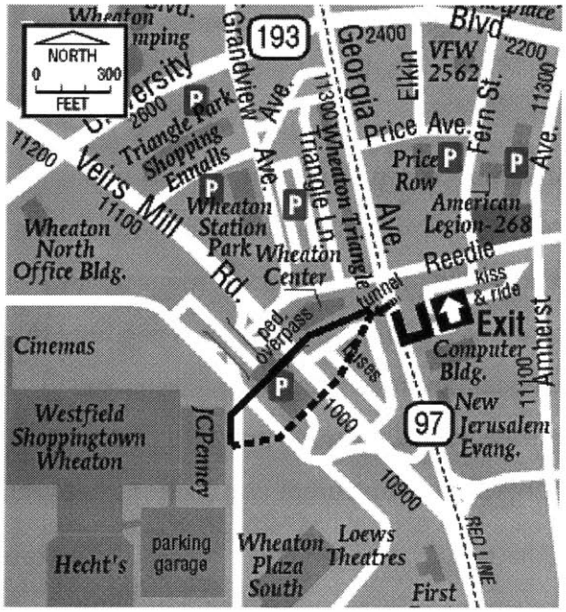


Figure 4.4
Wheaton Station
Montgomery County, Maryland

The intended route from the station (marked with the 'U' shape) to the mall is marked with the solid line; the observed preferred route with the dashed line

The garage is located between the station's west entrance and Westfield Shoppingtown Wheaton, a shopping mall. Also separating the mall from the station is Viers Mill Road, a six-lane thoroughfare, over which a pedestrian bridge was built and integrated with the parking garage (see Figure 4.5). Bollards and chains are meant to discourage jaywalking, but there is little to encourage use of the bridge. Its location is obvious and it is designed attractively enough, faced in brick and featuring architectural details (see Figure 4.6).

Figure 4.5

Pedestrian bridge over Viers Mill Road with parking garage at left; Metro entrance (not seen) at right

Figure 4.6

Interior of the pedestrian bridge with architectural detailing

However, the walk to the mall over the bridge is quite an obstacle course. The stairwells on each end of the bridge and at the mall side of the parking garage are rather narrow and have windows facing only toward the street, not toward the sidewalk, where they could give passersby a view in and provide a greater sense of security (Figure 4.7). After walking two flights of stairs (or taking the elevator) and crossing the bridge, one must negotiate the dark confines of the parking garage (Figure 4.8). Small, not particularly prominent signs mark the way, which does lead directly through to the other side (Figure 4.9). The exit through a narrow doorway faces away from the nearest mall entrance. The result is that there is no direct line of sight between the mall entrance and the entrance to the parking garage (Figure 4.10). Unless one has previously walked from the Metro station to the mall, there is no way of knowing that the parking garage provides access to it. The only clue is the Metro symbol emblazoned on the façade of the stairwell.

Figure 4.7

Narrow stairwell to bridge has windows on one side only

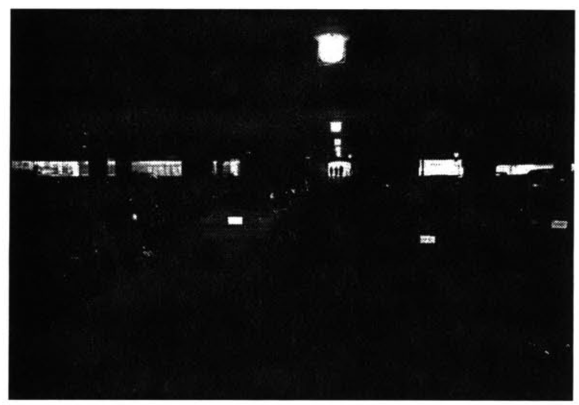


Figure 4.8

Passage through the parking garage looking toward the bridge

Figure 4.9

The mall side of the parking garage The crosswalk is not aligned with the with it, and the Metro sign is very small

Figure 4.10

At the mall entrance, the parking garage stairwell is in view, but the doorway cannot be seen

Not surprisingly, individuals walking to and from the metro station prefer crossing at grade. This is an obstacle course of its own, as shown in Figure 4.11. The pedestrians at the top of the stairs have walked from the mall entrance (background) through the corner of a parking lot and will proceed through the garage entrance and exit lanes. Walking around the corner of the garage, Viers Mill Road comes into view (Figure 4.12). Those who disregard the bollards and chains and jaywalk find that they still must walk through the kiss-and-ride before reaching the Metro entrance (Figure 4.13). To add insult to injury, Wheaton station's escalators are the longest in the Metrorail system—the longest in North America, in fact—requiring over two-and-a-half minutes to ride (standing) from the surface to the platforms. It is difficult to imagine that many mall shoppers who have access to a car would take Metro to get there, even though less than 300 m (1,000 ft) separate the station portal from the mall entrance.

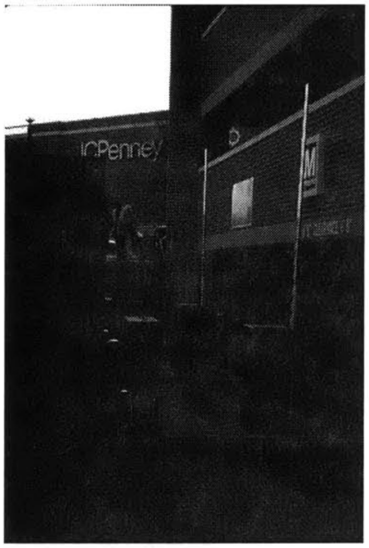


Figure 4.11

The observed preferred route cuts through the garage entrance/exit

Figure 4.12

Pedestrians frequently disregard the bollards and chains and jaywalk

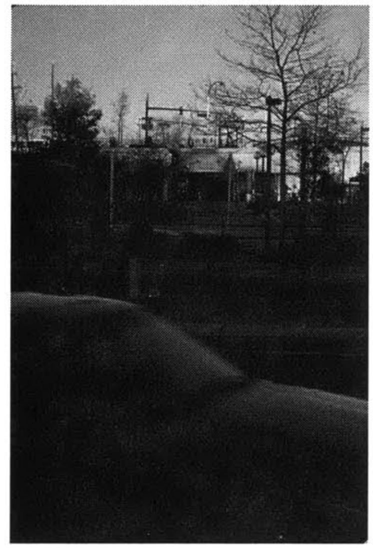


Figure 4.13

The view from the far side of Viers Mill Road toward the station entrance portal

Better examples can be found on the western end of the Red Line, also in Montgomery County. Rockville Station (Figure 4.14) is separated from downtown Rockville by Hungerford Drive. A pedestrian bridge integrated into the station crosses the kiss-and-ride area and the busy thoroughfare to give access to the offices, shops and apartments beyond (Figure 4.15). Unfortunately, the pedestrian must descend from the platform to the station mezzanine, which is below ground level, and then ascend two levels to reach the bridge. The flooring and materials of the bridge's interior, however, are the same as those used throughout the Metro system, lending a sense of continuity as one negotiates the various changes in level. Once across, the bridge leads to a pleasant promenade between two office buildings that features shade trees and seating (Figure 4.16).

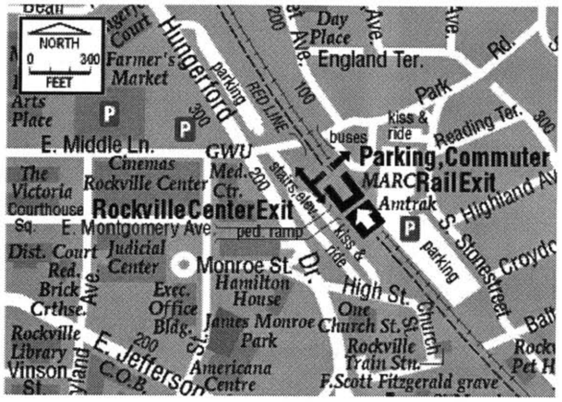


Figure 4.14
Rockville Station
Rockville, Maryland

The station (marked with the 'U' shape) is adjoined by a pedestrian bridge (marked "ped. ramp") connecting it to the axis formed by Montgomery Avenue

Figure 4.15

View of the pedestrian bridge from the station platform

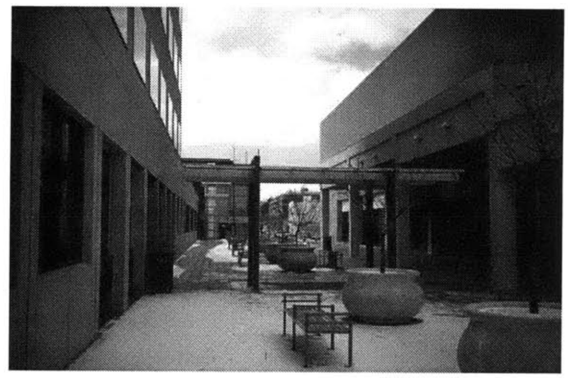


Figure 4.16

At the opposite end of the bridge looking away from the station

This leads to a very wide stairway that gradually brings the pedestrian to ground level at Monroe Street (Figure 4.17). Continuing this axis is Montgomery Street, newly fronted with a theater, sidewalk cafés, and, still further, condominiums above shops. The activity and interest these uses generate, as well as wide sidewalks (sheltered by an arcade on the south side of the street) and historic street lamps, create a pleasant walking environment (Figure 4.18).

Figure 4.17

On Monroe Street looking toward the the station; note elevator (at right)

Figure 4.18

Montgomery Street, with sidewalk café (foreground) and condos above shops (center)

It could not be readily observed, as at Wheaton Station, that an at-grade route from the Metro station to the downtown area is preferred to one using the pedestrian bridge. However, it would require walking through the station's kiss-and-ride area to cross six-lane Hungerford Drive, then walking around an office building along Monroe Street, a much less direct route. The pedestrian bridge and promenade, on the other hand, form an intuitive extension of Montgomery Street leading directly to the Metro station. The wide stairway on the western end and the consistent use of materials on the eastern end smooth the transitions from ground level to the bridge that occur so abruptly at the bridge at Wheaton Station.

Also along the Red Line's western end, Bethesda Station is connected to its surroundings by a network of grade-separated pedestrian paths (Figure 4.19). Unlike Rockville and Wheaton stations, however, Bethesda Station is located directly under a business district and thus does not suffer from the same degree of isolation from its surroundings as do the other two stations. While the streets in the station area do not present significant barriers to pedestrians, a pedestrian tunnel and bridges provide convenient connections throughout downtown Bethesda. The bridges work because they compose a continuous route from the metro station entrance without changes in level. Similarly, the tunnel does not require passage down and up again after reaching the surface, but facilitates movement in a continuous ascent or descent.

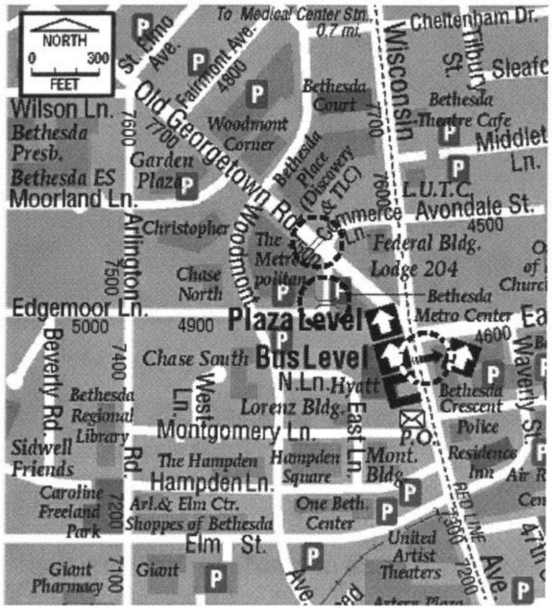


Figure 4.19
Bethesda Station
Bethesda, Maryland

Two pedestrian bridges (circled, on the left) and a pedestrian tunnel (circle on the right) connect the station (marked with the 'C' shape) to its surroundings

Upon arriving at the surface from the station platforms, a tunnel at the same level allows easy crossing of Wisconsin Avenue. The tunnel leads to the basement level of an office building where convenience shops are located and an escalator provides access to the lobby and street. Artistic lighting in the tunnel and shops provide interest and activity, allaying fears that may be associated with subterranean passages. A station identification pylon on the far side of Wisconsin Avenue identifies the tunnel (Figure 4.20).

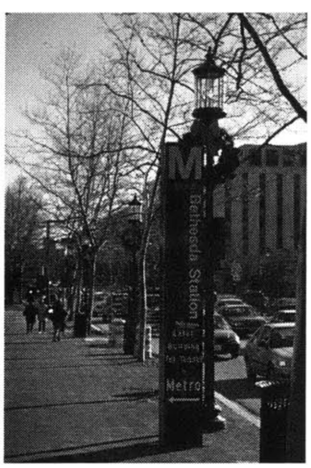


Figure 4.20

Pylon directs metro riders to tunnel under Wisconsin Avenue

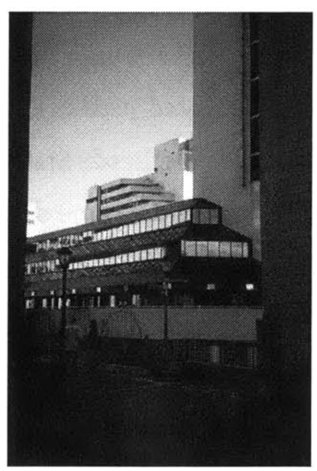


Figure 4.21

Looking toward the station from condos (accessed by pedestrian bridge at left)

Back on the station side of the street at the station portal, escalators directly ahead ascend to an attractive plaza surrounded by a hotel and office buildings. At the western end of the plaza, a pedestrian bridge crosses Edgemoor Lane, the main route of access to the station's bus loop and kiss-and-ride and not a particularly pleasant place to walk (Figure 4.21). This leads through The Metropolitan, condominiums situated around a semi-public greenspace. Still another bridge crosses Old Georgetown Road, providing an additional block of offices and residences access to metro without having to cross streets. However, the sidewalks at street level remain attractive places to walk, enlivened by storefront windows and shade trees (Figure 4.22).

Figure 4.21

A second pedestrian bridge (center) is at the same level as the urban plaza at the station entrance; it provides convenience while streets below remain walkable

Pedestrian bridges and tunnels can increase the area of influence for pedestrian trips in station areas, linking station entrances across barriers to activity centers beyond. However, when circuitous routes and inconvenient movements are necessary to use them, they will attract little use, as at Wheaton Station. Even when movement to a second level and back is required, as is often the case, these can be made more tolerable through design interventions, as seen at Rockville Station. Overpasses and underpasses are most successful when they incorporate a change in level that the pedestrian is already going to make. The tunnel and bridges serving Bethesda Station facilitate a continuous direction of vertical travel from the station platform to the pedestrian's ultimate destination. While other factors certainly influence ridership, there appears to be a definite correlation between pedestrian-friendliness and ridership growth. Commuting to jobs at each of the three station areas, as measured by exits in the morning peak hour, has grown markedly at Bethesda: 38 percent between 1995 and 2000. The corresponding rate of growth for Rockville is a smaller, though still impressive 33 percent, while the number of riders exiting at Wheaton in the AM peak over the same five-year period has remained virtually unchanged.[16]

4.2.3 Multiple Station Entrances

Moving even closer in, the layout of the station itself can contribute to or detract from the directness of pedestrian routes. Intuitively, multiple station entrances expand the reach of the station and facilitate more direct routes. A typical transit station is several hundred feet in length. With only one entrance, the theoretical catchment area is πr^2, with r as the catchment radius of about half of a kilometer (a third of a mile). With an entrance at either end, it is increased by $2rx$, with x being the station length. Multiple station entrances acknowledge the pedestrian. While a station designed to serve a park-and-ride lot and/or feeder bus loop can do so with one entrance focused to spill riders out towards them, additional entrances consider the varied destinations pedestrians have. Going several hundred feet out of one's way in an automobile or bus is relatively insignificant compared to doing the same on foot.

Of course, additional station entrances are expensive, especially in the context of heavy rail systems where grade-separated crossing of the tracks must be provided. Additional entrances often require additional staff and equipment, as well as elevators to meet Americans with Disabilities Act (ADA) requirements. Given fiscal constraints, it may be difficult to justify an additional entrance, especially when pedestrian activity is currently low. For this reason, provisions should be made for future station entrances when the demand justifies them. As Erin Deeming recommends, "station areas should be allowed and expected to evolve over time."[17]

[16] Ross 2000
[17] Deeming 1998, 137

This has been the experience of Ballston-MU Station in Arlington County, Virginia. When it opened in 1979, Ballston-MU was the terminus of the Orange Line and "functioned mainly as a bus turnaround and transfer point" surrounded by one- and two-story commercial buildings. Now Ballston-MU is described as "Arlington's premier urban center" and includes a 28-story hotel, office, retail and condominium complex.[18] Still served by only one entrance, the station has one of the highest levels of boardings among single-entrance stations in the Metrorail system. However, provisions were made when the station was constructed so that essentially only the walls at the far end of the station have to be knocked out in order to establish a second entrance. This is planned for completion by the end of 2003, and will serve a number of new developments now under construction. The new entrance and additional elevators are expected to increase transit ridership by nearly 8 percent, attracting 1,600 additional boardings a day. Access to the station for some riders will be reduced by as much as 400 m (one-quarter mile) and more than 2,000 daily pedestrian crossings of Fairfax Drive, a busy arterial, will be eliminated.[19]

The Baltimore Metro offers some lessons with regard to the value of multiple station entrances. The initial stations that opened in 1983, with the exception of two downtown stations, have only one entrance. The typical station design brings passengers from the single entrance to a voluminous mezzanine with roughly the same dimensions as the platform below. The mezzanine could be accessed on all four sides, but only one point of access is provided. Mondawmin Station is located adjacent to Mondawmin Mall, yet metro riders must exit the station in the opposite direction, turn around, and then negotiate a parking lot before reaching the nearest mall entrance. A station exit at the far end of the mezzanine could bring riders directly to the mall entrance, and is currently under study. The line's two newest stations, opened in 1995, both have two entrances each. At Shot Tower/Market Place Station, the mezzanine is separated into paid and unpaid areas with a central station manager kiosk and bank of faregates. Thus the expense of an additional set is spared. At Johns Hopkins Hospital Station, each entrance has a kiosk and bank of faregates, but an underground passage between the two allows for one

[18] Bernick and Cervero 1997, 219
[19] WMATA n.d.

side of the station to "close" during off-peak hours while still keeping its entrance open, maintaining the station's "reach". Through these new designs, the catchment area of a station is increased without necessarily doubling the cost of staffing the station.

4.2.4 Guidelines

In the preceding discussion, three ways of evaluating the directness of pedestrian routes to stations have been developed. In each case, it is shown that convenience plays a significant role in the pedestrian's use or disuse of a specific facility—be it a station entrance, a pedestrian bridge, or a crosswalk—and ultimately, the transit system itself.

Are there direct routes to the station?
Pedestrians have little tolerance for out-of-direction travel, especially in the vertical direction, and are inclined to jaywalk and step over barriers to avoid it if necessary. Opportunities to cross streets must match pedestrian desire lines. Gridlike street networks increase the amount and quality of direct routes, but cannot easily be "retrofitted" into neighborhoods. Instead, off-street connections can fill the gaps, and similar, pedestrian-only facilities can provide more direct routes over longer distances if they connect well with their surroundings and provide a reasonable level of security.

Do facilities for overcoming obstacles and topographical barriers—such as underpasses, overpasses, and ramps—invite use?
Heavily trafficked arterials, for example, may require pedestrians to travel out of their way to reach their desired destination. Pedestrian bridges, tunnels, and ramps can offer attractive "shortcuts". However, if they themselves introduce significant out-of-direction travel (up and down in multiple locations), their benefit is negated. These facilities work best when they facilitate movement from one level to another, and not from one level to another and back again. Continuous movement in one direction, without switchbacks or turning movements, is intuitive, direct, and more attractive.

Are multiple station entrances provided?

The catchment area of walk-up access is expanded with each additional entrance. In systems with controlled access, multiple entrances can still be provided when only one access point is desired: entrances fan out from mezzanine levels. Even when additional entrances are not initially justified, provisions should be made for future entrances, so that ideally, both platform ends facilitate direct access in a continuous direction of travel.

4.3 Continuity and Integrity of Pedestrian Routes

In this section the most basic requirements for pedestrian access to transit stations are discussed. Routes must be *continuous*, without gaps between sidewalks or other pedestrian facilities; as well as *integral*, a complete system with these facilities provided along both sides of all public streets and otherwise connecting to desired origins and destinations in a station area. In less pedestrian-friendly conditions, sidewalks are not consistently provided. Even when they are, they may be too narrow or obstructed, or are fragmented by numerous curb cuts for driveways, all of which discourage use. The following discussion presents findings on the effect continuity and integrity of pedestrian routes have on promoting walking as well as strategies to improve these qualities.

4.3.1 Sidewalk Availability

Sidewalks represent the standard for providing a public right-of-way for pedestrians separate from automobile traffic. In the best of circumstances, sidewalks line both sides of public streets, providing pedestrian access to all residences and businesses along them. While sidewalks may be taken for granted in urban locations, they are often missing in suburban areas. In rural conditions, off-road paths facilitate walking and low volumes of traffic allow the small numbers of pedestrians to comfortably use the shoulders of roads.

Attempting to replicate a rural atmosphere, many suburban subdivisions eschew sidewalks, even when the numbers of pedestrians, density of development, and traffic volumes in and around them are very different from those in rural communities. With the rapid expansion of suburban development into formerly rural areas, old preferences and sensibilities clash with new realities. This is evident in such places as burgeoning Fairfax County, Virginia, where neighborhoods in which it is still fashionable not to have sidewalks are juxtaposed with some of the nation's highest concentrations of commercial and residential development outside of a traditional central business district. WMATA's Orange Metrorail Line penetrated the county in the mid-1980s, placing transit stations in areas with limited sidewalk availability. Figures 4.22 and 4.23 show the discontinuous sidewalk network around Vienna/Fairfax-GMU Station, the Orange Line's terminus.

Figure 4.22
Lee Highway near Vienna/Fairfax-GMU Station
Fairfax County, Virginia

There is no sidewalk on the south side of the highway (left) and the sidewalk on the north (right) ends before Nutley Street, which leads to the station

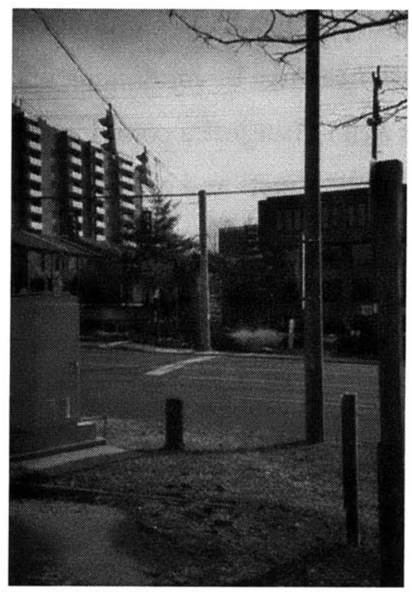


Figure 4.23

The high-density Circle Towers condominiums incorporate offices and shops near the station; on the "metro side" of the highway, however, there are only utility elements, no sidewalk

Perhaps West Falls Church/VT-UVA Station illustrates the most extreme case. Access to the station, vehicular or otherwise, can occur only from Haycock Road, which at the inception of Metro service had no sidewalks on either side. A study of pedestrian and bicycle access to the four outer Orange Line stations conducted shortly after their opening notes that "pedestrians walking east from Route 7 to the station must use a dirt path on the north side of Haycock Road".[20] Route 7 is the "Main Street" of Falls Church, a colonial town predating the suburbanization of Fairfax County, and the station's namesake. A high school campus blocked a direct route from Route 7 to the station, and the lack of any access routes from the north side of the station, located in the middle of I-66, severely limited the possibilities for walking to the station.

Nearly a third (28.6%) of the respondents to the study mentioned above cited the lack of sidewalks as a reason for not walking to one of the four Orange Line stations. The only reason receiving a greater response (82.7%) was "distance too far", which, though a separate issue, does relate to sidewalk availability. Given more complete sidewalk networks, walking distances would be shortened. East Falls Church Station, the next inbound from West Falls Church/VT-UVA and the closest of the four to Washington, is located in the midst of a residential neighborhood with a gridlike street pattern and a high level of sidewalk continuity. More than four times as many Metro riders walked to this station (21.4%) than to West Falls Church/VT-UVA (5.0%) although only 3.4 km (2 mi) separate the two stations. When asked to give a reason why they did not walk to one of the Metro stations, West Falls Church-area respondents had the highest percentage among the four stations for "no sidewalk", 35.2%, significantly greater than the others (East Falls Church, 28.6%; Vienna/Fairfax-GMU, 23.8%; and Dunn Loring-Merrifield, 22.1%).

Even more compelling are the results for those that the study identifies as "potential walkers"—those who did not cite reasons such as "too far", "too much to carry" or "weather fluctuations" for not accessing Metro on foot. These riders would potentially walk to the stations if some kind of improvement in the physical environment were made. 74 percent of them living near West Falls Church/VT-UVA gave "no sidewalk" as a reason, considerably higher than the proportion of respondents in the other station areas (East Falls Church and Dunn Loring-Merrifield, each 66.7%; Vienna/Fairfax-GMU, 60.0%).

[20] Neumann 1989, 24

The study noted several planned improvements that would assist pedestrian access to West Falls Church/VT-UVA Station (refer to Figure 4.24):

- 1.5 m (5 ft) wide sidewalks on each side of Route 7 west of Haycock Road
- a 4.3 m (14 ft) wide "pedestrian area" on Route 7 east of Haycock Road as it enters the Falls Church CBD
- 1.5 m (5 ft) wide sidewalks on each side of Haycock Road between Route 7 and I-66
- 1.5 m (5 ft) wide sidewalks on each side of Haycock Road between I-66 and Great Falls Road

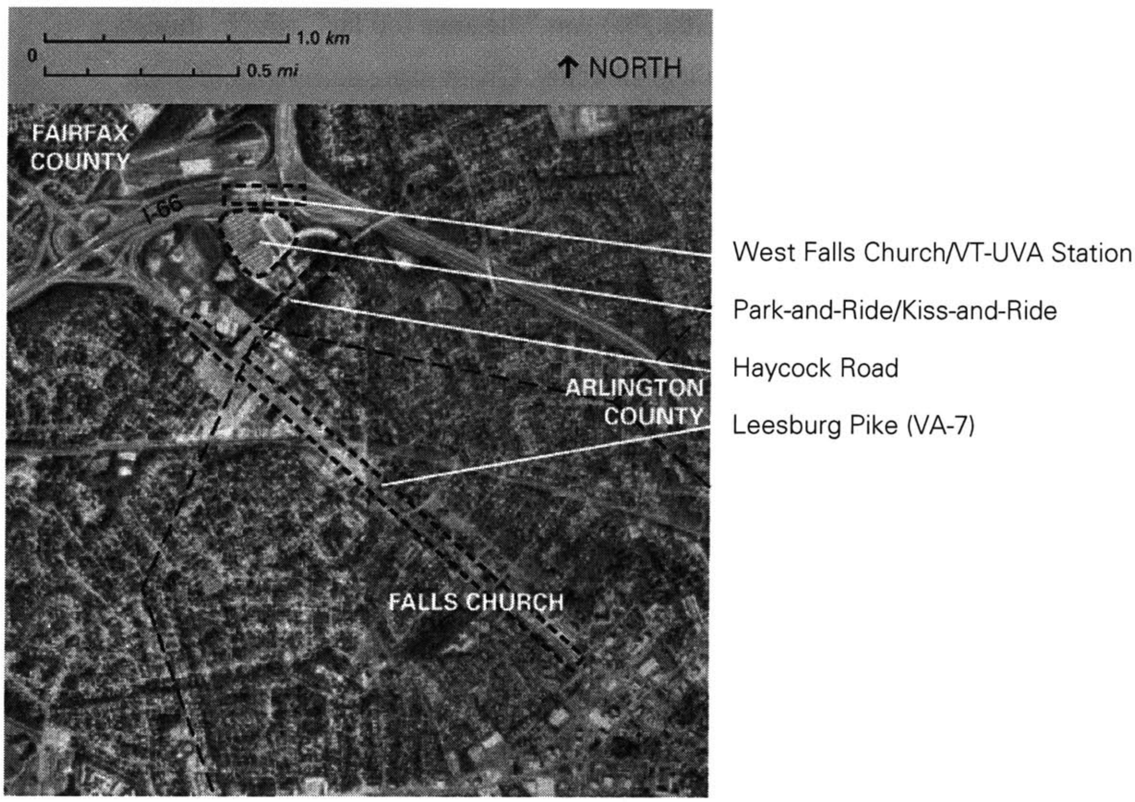


Figure 4.24 ***West Falls Church/VT-UVA Station***
Fairfax County, Virginia

A site visit in early 2001 confirmed that all except the latter improvement have been implemented. A direct connection between Route 7 through the high school campus has been established. In addition, a university extension center (housing Virginia Tech and the University of Virginia) and a condominium development have been built adjacent to the station's large park-and-ride lot since the study was conducted. Also, in recent years a strip-mall shopping center at the corner of Route 7 and Haycock Road has undergone a facelift including a number of pedestrian enhancements (see Figure 4.27). All of these changes in the station area help explain an increase in ridership experienced at West Falls Church/VT-UVA in recent years. Figures 4.25 and 4.26 graphically depict the ridership and parking capacity history of the four-station extension since it opened in 1986.

Figure 4.25
Outer Orange Line Metrorail Ridership

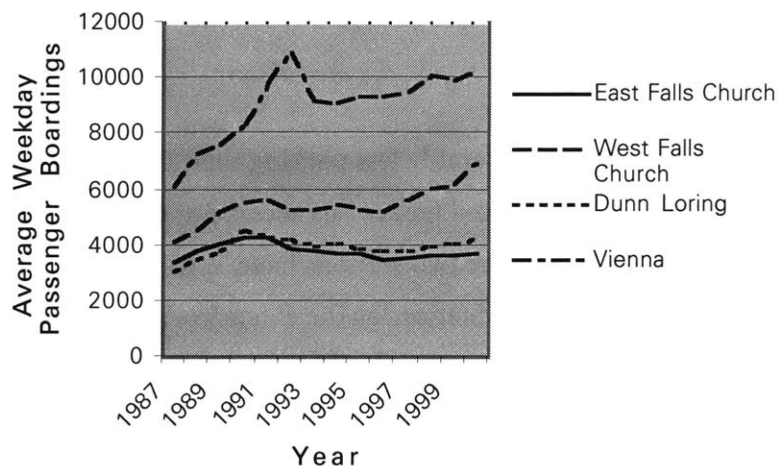
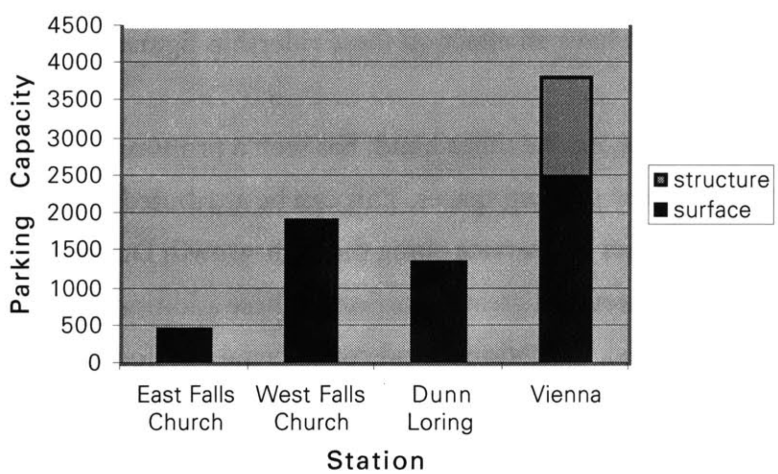


Figure 4.26
Outer Orange Line Metrorail Parking



In general, ridership on the extension grew steadily into the early 1990s, peaking and then declining gradually until a definite turnaround occurred in the late 1990s. The current upward trend is expected to continue, especially with the soon-to-be-completed second parking structure at Vienna/Fairfax-GMU Station, which will increase that station's park-and-ride spaces by 40 percent. With the exception of Vienna/Fairfax-GMU, parking capacity at the stations has remained essentially constant and reflects individual station ridership. For example, a third to half as many more riders have typically boarded at West Falls Church/VT-UVA as compared to Dunn Loring-Merrifield, and the parking capacity of the two has the same proportion—40 percent more parking stalls at the former compared to the latter.

Though East Falls Church has considerably less parking than Dunn Loring-Merrifield, its far greater percentage of walk, bike, and feeder bus access put its ridership at a comparable level, and boardings at the two stations have, interestingly, closely followed the same trend. Vienna/Fairfax-GMU Station, as the extension's terminus with much larger parking facilities, leads the others in ridership but follows the same pattern. The more pronounced growth and decline could be explained by the construction of a parking structure, which temporarily removed but eventually increased overall capacity significantly. Recent construction of residential units near the station may also explain why growth has been higher there than at East Falls Church or Dunn Loring-Merrifield, both of which have seen little new development around them (until very recently for the latter, which could not yet have an effect on these ridership figures).

West Falls Church/VT-UVA, on the other hand, has seen a pronounced increase in boardings without any new parking spaces. This can be attributed in part to the introduction of new express bus service along the high-growth Dulles Airport corridor that feeds the station. However, a greater portion of these additional trips are certainly the result of the new residential, educational, and commercial development within easy walking distance of the station, as well as the attendant sidewalk improvements (see Figure 4.27). It is difficult to isolate the effect of the new sidewalks alone, and it is not known exactly when each facility or development was constructed. It is reasonable, however, to expect that the new development without the sidewalks, or the sidewalks without the development, could not have had the same impact on Metro ridership. A synergy is created by the two, in which the combined effect of the two changes is greater than the sum of the effect each would have had alone. In any case, nearly three-quarters of the "potential walkers" identified in the study cited "no sidewalks" as a deterrent to their accessing the station on foot—a reason given more often than any other. With such facilities now available almost completely in the station area, it is certain that more people are walking to West Falls Church/VT-UVA station than ever, boosting ridership and making parking spaces available to still further Metro patrons (see Figure 4.28).

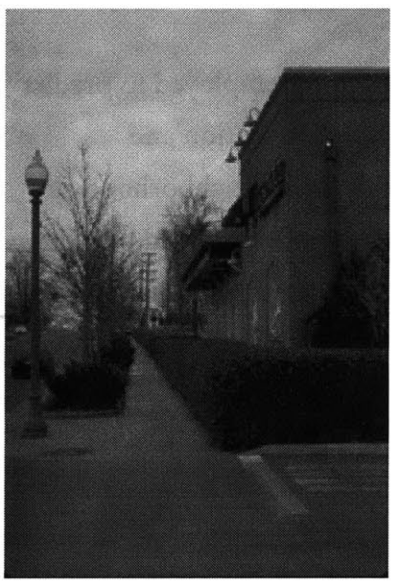


Figure 4.27

A renovated strip retail center along Leesburg Pike features attractive sidewalks addressed by outparcel buildings

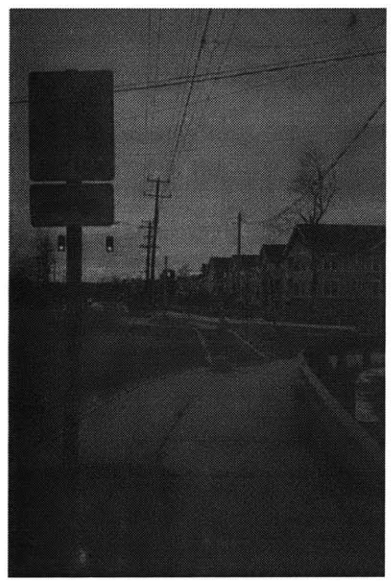


Figure 4.28

The sidewalks and condominiums shown were not present when the nearby station opened in 1986

Research conducted by Hess, Moudon, Snyder and Stanilov in metropolitan Seattle also substantiates the comparative analysis of the western end of the Orange Line in northern Virginia. Their study does not focus on transit station areas but on neighborhoods centered on commercial centers in the Puget Sound region. A comparison is easily drawn between the two, as both the Orange Line stations and the neighborhood commercial centers draw pedestrian travel from a certain surrounding area largely residential in character. The researchers identified a dozen neighborhood commercial centers, half of which are located in more urban areas and the other half in more suburban areas. The sites were selected so that physical characteristics could be isolated to determine their effect on pedestrian travel. Accordingly, each of the dozen neighborhoods has similar gross population densities, land use types and mixes, as well as income levels. They differ, however, widely with respect to mean block size, length of the sidewalk system, and the character of parking opportunities. The research team also found three times the amount of walking to the central commercial center in the urban neighborhoods compared with the suburban neighborhoods.

Through these findings, they maintain that typical measures usually employed to predict pedestrian volumes—population density, income, and land use distribution and intensity—are together insufficient. Physical characteristics—such as neighborhood site design, block size, and the extent of pedestrian facilities—also must be factored into the equation.[21] The research team points out that linear relationships were not as apparent between pedestrian travel and any of these variables alone, but were significant in comparisons of pedestrian travel with the aggregate of physical characteristics. This parallels the synergy described with respect to new development and new pedestrian facilities at West Falls Church/VT-UVA Station.

The study of Puget Sound neighborhoods shows that complete and continuous sidewalk networks have a positive effect on the level of pedestrian travel. The six urban neighborhoods feature sidewalks on both sides of every street, with an average of over 60 km (37 mi) in total length within a radius of 800 m (0.5 mi). In the suburban neighborhoods, only somewhat more than a fifth of this amount was found to be the average. To line both sides of every street, however, the total sidewalk length in the suburban neighborhoods would only need to be doubled. This is because of the much smaller total street length in these neighborhoods, resulting from much larger suburban

[21] Hess et al 1999, 12, 14

blocks. Not surprisingly, the researchers found the sidewalk networks in these areas to be incomplete and discontinuous.

Nearly all pedestrian trips in the urban neighborhoods (98%) were facilitated by sidewalks, demonstrating their ubiquity in those locations. In contrast, only 43 percent of the "entry points" to the suburban commercial centers had sidewalks. The research team notes that 60 percent of suburban pedestrians used those entry points—indicating a preference for sidewalks.[22] And just as there tend to be "missing" sidewalks in such concentrations of commercial activity, the study points out that corresponding residential concentrations—multi-family housing complexes and the like—ironically have less extensive sidewalk networks than in lower-density, single-family subdivisions, where they are often required by regulations. Overall, perhaps the most important findings of the research team are considerable volumes of pedestrians in the suburban neighborhoods, despite the adverse walking conditions, and the fact that these were found to have the same overall densities as the urban, more transit-oriented neighborhoods studied.

Indeed, hoping to find just a handful of examples where densities between urban and suburban neighborhoods would approximate one another, the research team found 85 Puget Sound neighborhoods that fit the established criteria. They suggest that many suburban areas are likely "to already have the requisite population densities and land use mix and intensity to support walking," contrary to conventional wisdom.[23] Seemingly, all that is missing to turn many suburban development clusters into more walkable communities are improved design characteristics. Providing sidewalks along both sides of all streets is a fundamental step in meeting this end.

4.3.2 Sufficient Sidewalk Width

It is not enough to provide sidewalks, but they must meet minimum dimensions in order to be accessible to all. When sidewalks are too narrow, they can be rendered useless. Some

[22] Hess et al 1999, 15
[23] Hess et al 1999, 17

pedestrians, due to a disability or other conditions, may simply not be able to use a sidewalk that is too narrow. Even when use is not limited in this manner, a narrow sidewalk sends the message: "you are not really supposed to walk here", because the "level of service" being provided is so low. Sufficient sidewalk width is not only determined by a sidewalk's physical dimensions, but also by its being clear of encroaching obstructions. These typically include vegetation, fire hydrants, posts, newspaper vending boxes, mailboxes, utility boxes and architectural features, all of which can reduce the effective width of a sidewalk. Utility boxes—including traffic control boxes, street lighting meters and transformers—can especially be a problem because they need to be in the public right-of-way for easy access (see Figure 4.23). Vegetation—including trees, shrubs, and overhanging branches—can add much to a pleasant walking environment but are an obstacle when they encroach into pedestrian paths.

As is often true, meeting the needs of the disabled community in the design of public facilities more than accommodates the population not similarly handicapped. Thus guidelines formulated with respect to disabled needs form the basis for any question involving the design and dimensioning of public facilities such as sidewalks. The Access Board, a federal agency committed to accessible design, has produced a "Rights-of-Way" report to underpin its continuing efforts to establish guidelines for making public rights of way accessible. It recognizes that clearances needed indoors are often insufficient in outdoor, public rights-of-way, like sidewalks.

> Travel in the public right-of-way is generally faster... Pedestrians, including persons with disabilities, are much more likely to travel side-by-side or in groups in the public right-of-way.[24]

A rule of thumb is that a sidewalk of sufficient width will allow a pedestrian to comfortably pass two pedestrians walking abreast in the opposite direction. It follows that two wheelchair users should be able to pass one another without difficulty on a sidewalk, and the Public Rights-of-Way Access Advisory Committee (PROWAAC) has determined that at least 1.83 m (6 ft) of width is required to meet this end.

[24] PROWAAC 2001

Unfortunately, sidewalks do not often meet this minimum standard, and areas with sidewalks of insufficient width are often compromised in other ways as well. Utah Transit Authority's (UTA) TRAX light rail system operates between Salt Lake City and its southern neighbors in a railroad corridor, from which activity and development have shifted away. In Murray, the line comes close to Fashion Place Mall, one of Utah's first and today one of the state's largest and most profitable enclosed shopping centers. Murray city officials wished to name one of the municipality's three light rail stations after the mall, giving substantial "free advertising" to the city's largest source of tax revenue. UTA officials pointed out that this designation might mislead riders about the proximity of the mall to the station, and so the name "Fashion Place West" was agreed upon. The distance from station platform to mall entrance is just a little over half a mile—but is likely to be perceived as much longer because of the less than ideal walking conditions en route.

Sidewalks are provided all along Winchester Street between the mall and the station, but the bridge crossing over I-215 gives pedestrians only a 1.2 m (3.9 ft) berth between a jersey barrier and the chain link fence facing the freeway traffic below. Figure 4.29 shows an over-dimensioned parking lane next to the constrained pedestrian right-of-way. Wheelchair users would find crossing the bridge a harrowing experience, and pedestrians faced with the low level of comfort and the high degree of exposure to automobile traffic would get the message: "it's not really intended that you walk here."

Figure 4.29 ***Fashion Place West Station***
Murray, Utah

Narrow sidewalk on freeway overpass

(view: looking west toward TRAX station)

Besides insufficient width, other characteristics of sidewalks and paths can compromise their effectiveness. The quality of the surface may impede their use, particularly by the disabled. Bricks may be attractive, but it is difficult to maintain an even surface using them as a paving material. A general problem that is especially aggravated by bricks is damage caused by tree roots breaking up the pavement of sidewalks. This can be addressed by selecting species with deep-reaching roots for use as street trees and keeping sidewalks in good repair. On the other hand, even surfaces can become slippery when wet as well, calling for some kind of texturing if concrete is used. Finally, bright white concrete is undesirable as well, due to the glare it reflects on sunny days. The aggregates used in mixing the concrete should be selected to minimize reflectivity.

4.3.3 Limited Curb Cut Conflicts

While sidewalks that are too narrow inhibit sidewalk effectiveness laterally, curb cuts do the same perpendicular to the direction of travel. In urban areas, curb cuts for driveways occur less frequently than in suburban locations because of the preponderance of on-street parking. Along residential suburban streets, frequent driveways usually do not present a problem for pedestrians because of the comparatively low volume of "traffic" that a single-family home generates.

Where conflicts do arise is along the commercial strips so common in suburban areas. High-traffic arterials spill over into large parking lots, and the sidewalks that separate them, if at all present, become very inhospitable places to walk. Motorists are driving at higher speeds than on residential streets, and the overall domination of the automobile makes the pedestrian less prominent in their minds. Full-fledged public streets also present obstacles to pedestrians—but they usually occur less frequently, are more conspicuous, and often include pedestrian signals and markings. Curb cuts for parking lots and driveways, on the other hand, can occur very frequently, are often difficult to discern (for both motorists and pedestrians) and are rarely outfitted with pedestrian-oriented features.

Returning to the example of Fashion Place West Station, Figure 4.30 shows how, within the space of a block, the sidewalk is interrupted by three curb cuts giving automobile access to parking lots. Continual movements in and out of the parking lots, during which motorists often pull out into the street and block the sidewalk while waiting for a gap in traffic, make walking unpleasant and unsafe.

A proposed solution for similar conditions along 400 South near downtown Salt Lake City shows how the needs of automobiles and pedestrians can be accommodated. A busy state highway, 400 South is already compromised with respect to walkability. A commercial strip for much of its length between downtown Salt Lake City and the University of Utah, it also is a major draw for pedestrians in surrounding neighborhoods and motorists alike. No later than early 2002, it will also be traversed by light rail trains shuttling Olympic visitors between venues. There is a definite need for an improved pedestrian environment.

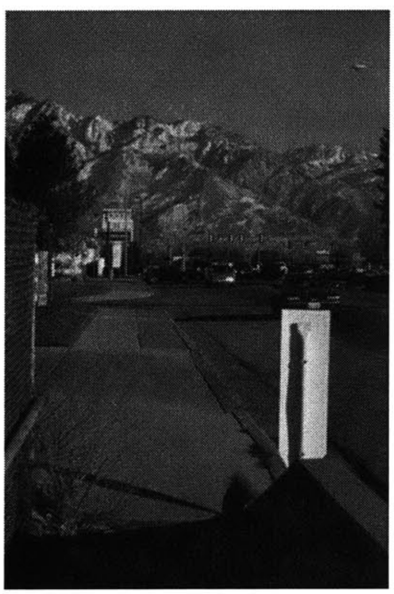


Figure 4.30 ***Fashion Place West Station***
Murray, Utah

Many curb cuts impede pedestrian travel

(view: looking east away from TRAX station)

The diagram in Figure 4.31 shows how a block where the future Trolley Square TRAX station will be located can be reconfigured to reduce conflicts between pedestrians and motorists. Access to the commercial buildings and parking lots is reduced but defined more clearly. Intrablock circulation for cars is provided by introducing a midblock through street, while the same for pedestrians is made possible by internal routes and midblock crosswalks for pedestrians. This conceptual solution remains to be tested, but shows how curb cut conflicts can be resolved. As the study accompanying the proposal advises, curb cut access is typically a fundamental right of property owners and efforts to limit curb cuts or reconfigure access to parking lots may likely require condemnation of property if business owners are not supportive of the idea.

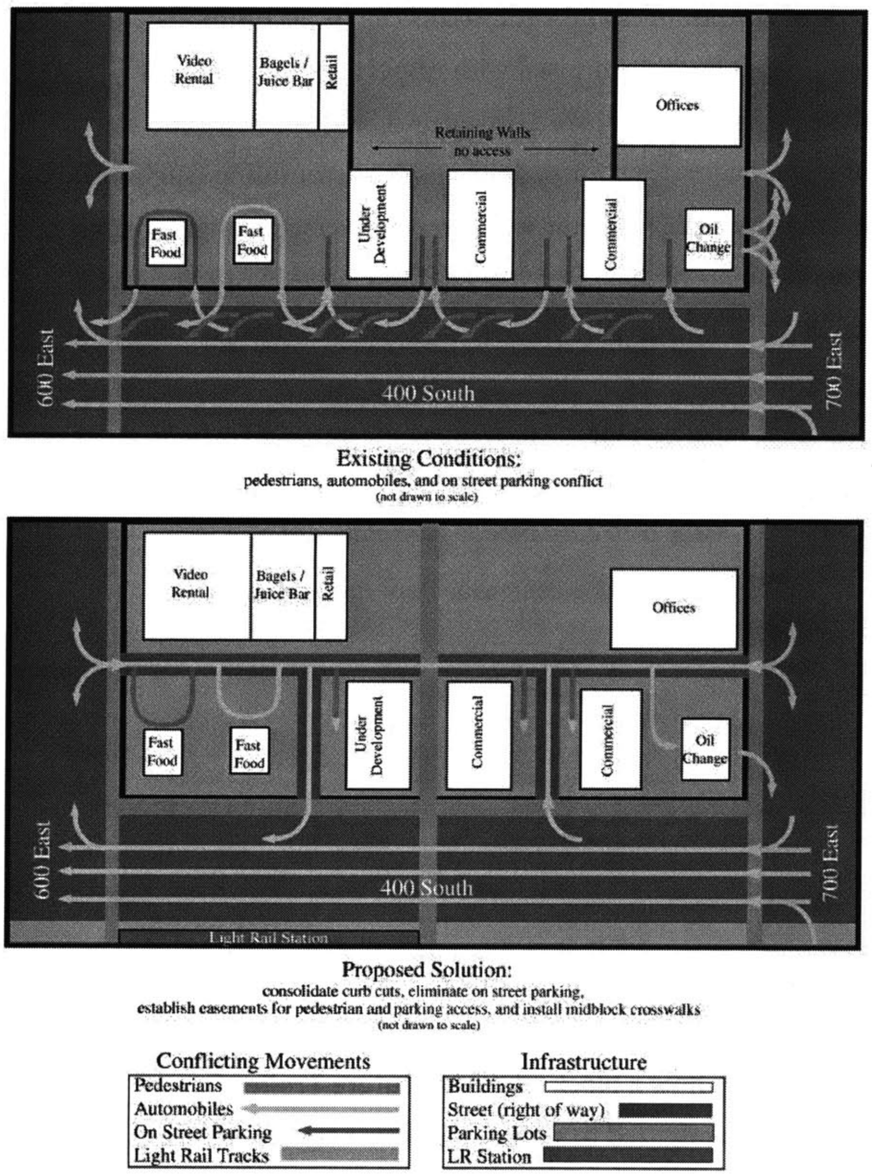


Figure 4.31 ***Conflict Mitigation Diagram for Future Trolley Square TRAX Station***
Salt Lake City, Utah

4.3.4 Guidelines

The preceding discussion has described three ways of assessing the continuity and integrity of pedestrian routes. An integrated system of sidewalks and pedestrian paths is needed to encourage walking to transit stations.

Are sidewalks available on both sides of all public streets in the station area?
Quite simply, when given a place to walk, people will use those places. Research has found that schools, multi-family housing and grocery stores in areas with compromised walking conditions—typical for suburbia—generate significant pedestrian traffic despite the less than ideal walking conditions. Transit stations represent a draw of comparable magnitude. Providing a complete sidewalk network around stations is essential for attracting more walk-up access.

Are sidewalks of sufficient width, with 1.83 m (6 ft) a suggested minimum?
For pedestrian comfort and disabled accessibility, sidewalks must be wide enough to allow users to pass one another without conflict. Two-way streets carrying any appreciable volume of traffic provide a lane for travel in both directions—pedestrians are no less deserving of adequate infrastructure. Depending on pedestrian volumes and the character of the adjoining uses, sidewalks and paths may need to be wider. For instance, the *Portland Pedestrian Design Guide* recommends a "through pedestrian zone" of at least 2.5 m (8 ft) in mixed-use pedestrian districts.[25]

Are sidewalks free of excessive curb cut conflicts?
Too many automobile crossings of sidewalks fragment the sidewalk network. Walking conditions improve as curb cuts for driveways are removed or consolidated, marked more conspicuously and designed to calm entering and exiting traffic.

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[25] POTED 1998, *Portland Pedestrian Design Guide* A-8

4.4 Ease of Crossing Streets

The willingness to walk is determined to a large degree by the ability to easily cross streets. Pedestrian routes to a transit station almost invariably include points of conflict with automobile traffic. At-grade crossings predominate and the challenge is to design them in a way that promotes pedestrian safety and comfort. A street in a station area which the pedestrian perceives as unsafe or difficult to cross (whether or not the perception is accurate) forms a barrier, which effectively limits the pedestrian catchment area of the station. Good walking conditions may prevail in an area on the far side of an offending street from the station, but this may not be sufficient to encourage the pedestrian to overcome the barrier of a busy or wide street. To reach the full potential of walk-up transit riders within a station area, the barrier-forming characteristics of the streets within it must be minimized. This section will describe three ways this can be achieved: through traffic calming measures, providing frequent crossing opportunities, and installing crosswalks and pedestrian-favoring signals.

4.4.1 Traffic Calming Measures

The speed of traffic threatens pedestrians and discourages them from crossing, even when crosswalks and signals are provided. As J.H. Crawford describes,

> ...an enormous power imbalance exists between a pedestrian and a car driver. If anything goes wrong, the pedestrian is likely to be seriously injured or killed. The car driver is unlikely to suffer anything worse than a dent in his car...many drivers still act like schoolyard bullies when they encounter a pedestrian.[26]

Children, the elderly, and the disabled are especially vulnerable. Young people tend to lack both experience in judgement that would help them make safe crossing decisions, and the confidence to assert themselves as pedestrians. The elderly and the disabled may have reduced sensory perception, which can lead to unsafe crossing decisions, and are

[26] Crawford 2000, 71

likely to respond and move more slowly than other pedestrians. As a result, parents may not allow their children to cross certain streets, and the elderly or disabled may choose to avoid them. Both groups are transit-dependent populations that are especially disadvantaged if busy streets block their walk to a transit station.

Traffic calming measures are street modifications designed to slow traffic in order to reduce the adverse impacts of traffic on human activities. Benefits that can be derived from traffic calming can be as diverse as reducing noise in homes, making it safe for children to play, as well as improving the walk to a transit station. A wide variety of measures can be employed to calm traffic. Facilitating on-street parking functions well as a traffic calming measure. Vehicles moving into or out of the parking lane, as well as the opening and closing of their doors, cause motorists to drive more cautiously and slowly. Wide streets with infrequent intersections encourage motorists to drive at higher speeds. As a countermeasure, "neckdowns" and "bulbouts" that decrease the number of the traveling lanes can be placed where pedestrians cross (see Figure 4.32). Shorter turning radii at intersections can also accomplish this where neckdowns and bulbouts are not an option. Still other measures include varying pavement materials or introducing obstacles that are uncomfortable for motorists to negotiate at high speed. While it is true that a pedestrian is more vulnerable than a motorist from a safety perspective, much can be done to remedy the imbalance that often exists between motorists and pedestrians. This can begin with traffic calming measures, particularly on streets near transit stations where pedestrian routes cross busy streets.

The plans for redesigning Charles/MGH Station, as described in the previous chapter, involve reconfiguring a busy intersection to better meet the needs of motorists and pedestrians. In particular, space that is now asphalt but not needed for traffic lanes will be reclaimed for sidewalk space. This will shorten crossing distances and make walking to the station more attractive and safe.

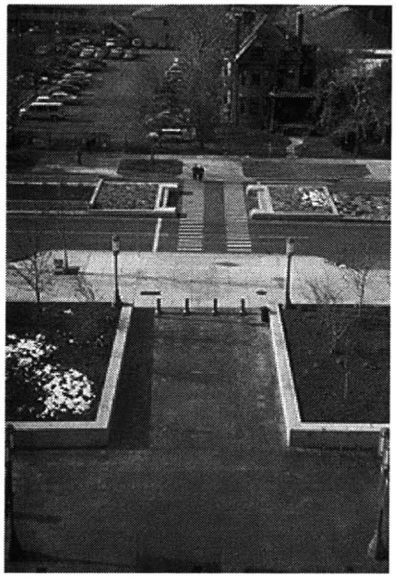

Figure 4.32 ***West Temple Street near Temple Square TRAX Station***
Salt Lake City, Utah

A "bulbout" of the sidewalk and "neckdown" of the street at this midblock crosswalk calms traffic and provides pedestrians a convenient crossing opportunity

4.4.2 Crossing Opportunities at Short Intervals

Frequent opportunities for safe crossing are needed to facilitate walking to stations. Recent research on pedestrian behavior provides insight to improving the ease of crossing streets. Sisiopiku and Akin studied pedestrian perceptions and behavior in a study of a 1 km (0.6 mi) section of a divided boulevard in East Lansing, Michigan. Though not in a transit station area, the street crossing preferences of pedestrians walking to and from stations are not likely to differ from those of pedestrians in general. Because the subject of the study, Grand Avenue, had been renovated just prior to the survey in an effort to improve the pedestrian environment, the results are especially informative. The renovations included warning signs, utilization of physical barriers, and new striping of designated midblock and intersection crosswalks. With an average daily traffic volume of 40,000 vehicles, the results are quite comparable to busy arterials where the ease of street crossing may be compromised.

Videotape reduction was used to record the actual movements of pedestrians, which correlated well with what survey respondents actually reported about their own behavior. This lends the survey increased credibility. The results are a cause for concern, especially from a pedestrian safety perspective. A high rate of crossing at locations other than at designated crosswalks was observed (41 percent of respondents indicated that they cross at *any* convenient location) and only four percent were willing to wait for a green pedestrian signal before crossing. From these results, it appears that it is relatively easy to cross the street—even at non-designated locations—which may be due to the presence of a median. Medians can be a very effective means of improving crossing conditions; however, they can encourage unsafe behavior on the part of both motorists and pedestrians. Drivers assume that pedestrians are safe and are not confronted with traffic coming in the opposite direction, encouraging greater speeds. Pedestrians, on the other hand, may dart out in traffic and cross to the median at locations where drivers are not expecting them. A way of preventing this is the use of vegetation or barriers to discourage crossing at undesired locations. In fact, 65 percent of the respondents indicated that vegetation or barriers affected their decision of where to cross. At non-designated crossing locations these should be considered, particularly when coordinated with efforts to improve crossing conditions at intersections. On-street parking, besides calming traffic, can also act as such a "barrier", as well as calming traffic.

Other factors influencing where individuals crossed include: presence of a midblock crosswalk (83%), presence of a pedestrian signal (74%), colored paving (58%), and shelters positioned on the median (35%). Sisiopiku and Akin conclude that special treatments such as these "may help pedestrians *locate* a crosswalk but appear not to have an important influence on their decision to cross at a certain location" [emphasis added]. They found that midblock crosswalks are actually more effective than signalized crosswalks at intersections in "accomplishing their design purpose". Other research by Rouphail supports this, as it finds that midblock crosswalks rate highly with respect to crossing convenience. Where long blocks increase the distances between crossing opportunities, midblock crossings are necessary to facilitate walking. The Portland Pedestrian Master Plan recommends "protected crossings at every corner or at 400' intervals, whichever is less."[27]

[27] POTED 1998, *Portland Pedestrian Master Plan* C-1

At intersections, the survey found that pedestrians found dissatisfaction from the conflict of left- and right-turning vehicles at crosswalks. This was often cited as a reason why a pedestrian crossed at a location other than at intersections. Remedies for this include shorter turning radii to slow vehicles down, which have the added benefit of reducing pedestrian crossing distances. NO TURN ON RED and YIELD TO PEDESTRIANS IN CROSSWALK signage can also warn motorists of the pedestrian presence and increase pedestrian confidence (see Figure 4.33). All things considered, 68 percent of those surveyed believed that crossing conditions on Grand Avenue were "safe for pedestrians", suggesting that the improvements— crosswalks, midblock crossings, signs, and barriers—had a positive impact on encouraging walking. Where pedestrian routes to a transit station cross busy arterials, similar interventions can encourage walking as an access mode.

Figure 4.33
Washington Street near
East Falls Church Station
Arlington County, Virginia

The sign restricts turning on red WHEN PEDESTRIANS ARE PRESENT

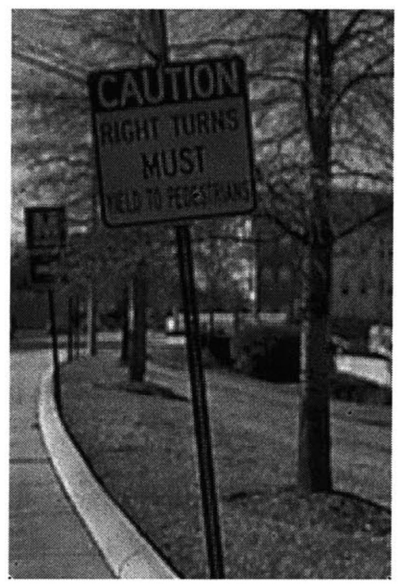

Figure 4.34
Eisenhower Avenue near
Van Dorn Street Station
Alexandria, Virginia

4.4.3 Provision of Pedestrian-Friendly Signals

Sisiopiku and Akin's research suggests that midblock crosswalks are likely to be accepted and used by pedestrians as well as those at intersections, although there is a low tolerance for waiting at pedestrian signals. Signals should provide both safety—by means of a red light for motorists and a WALK signal for pedestrians, as well as convenience—a short wait that encourages pedestrian compliance. An example of this is in the station area of Alewife Station, mentioned in a previous chapter. A midblock crossing of Rindge Avenue from the Fresh Pond Apartments, three high-rises of affordable housing, on the way to the station provides a WALK signal for pedestrians, activated by a pushbutton (see Figure 4.35). While an additional stoplight and signals are expensive, such a solution is relatively simple to implement from a technical perspective. More difficult is achieving the same level of convenience at intersections, where the cycles of traffic flows do not easily allow a preemptive intervention by pedestrians. Here the challenge is to allocate as much "green time" as possible for the pedestrian.

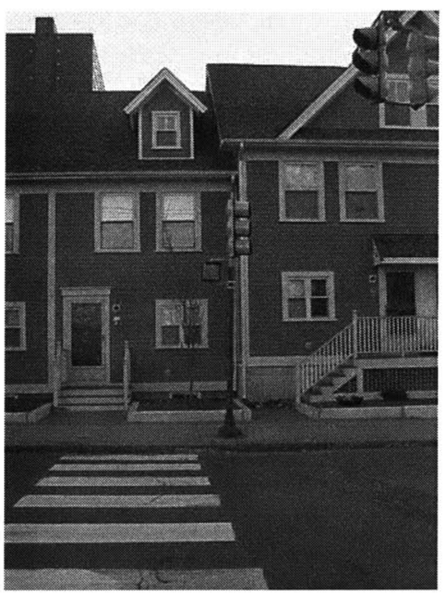

Figure 4.35 ***Rindge Avenue near Alewife Station***
Cambridge, Massachusetts

A signalized midblock pedestrian crossing activated by pushbutton provides a high level of service

Ken Kruckemeyer describes the problems that current signaling practices create for the pedestrian, explaining the tendency for non-compliant behavior. He suggests that a high "level of service" scenario for pedestrians—one in which the right-of-way is provided to them as they arrive at a crossing—is achievable within the entire range of crossing environments. At non-signalized, low-volume and low-speed streets, pedestrians face little delay at crosswalks where it is expected that motorists will yield to them. At a midblock crosswalk, whether signalized as at the Alewife Station example mentioned earlier or non-signalized yet well-marked for drivers, similar conditions are created. For signalized intersections, Kruckemeyer has developed a cycle and phase timing scheme that promises to achieve a WALK signal at least fifty percent to two-thirds of the time, while reducing the maximum wait for crossing to under one minute. He also suggests including a three second advance WALK to the cycle. Waits are inevitable with pushbutton activation at intersections and are therefore not recommended where there are high volumes of pedestrians, such as can be expected near transit stations. Especially during weather extremes of cold, heat, or precipitation, pedestrians have a low tolerance for the long cycles and delays from pushbutton activation in contemporary signalization. Kruckemeyer's cycle and phase timing sequence remains to be tested but offers a compelling solution to the crossing environment at intersections that the example of Grand Avenue in East Lansing typifies.

4.4.4 Guidelines

In order to expand the pedestrian catchment area of a transit station, the barriers formed by traffic must be overcome. Grade-separated solutions are absolutely necessary in certain situations but at-grade conditions prevail and are preferable when they can be safely designed. As a result, ease of street crossing is a major determinant of pedestrian-friendliness in station areas. Three measures of this quality have been developed in the preceding discussion and are formulated as questions below:

Does traffic threaten safety?

High-volume and/or high-speed arterials (the two usually, but not necessarily, accompany one another) form very effective barriers for pedestrians. These conditions can be ameliorated with traffic calming techniques, as the proposed redesign of

Charles/MGH Station in Boston demonstrates. Significant investment is planned to accomplish this, but the essential element is reducing the distance pedestrians must cross and the confusion they experience while attempting to do so. This can often be inexpensively achieved by striping narrower lanes and/or on-street parking lanes.

Are there short distances between intersections?

A corollary to this question is: ***are midblock crosswalks provided?***

This is a measure of how far a pedestrian must go out of his way to cross. While closely related to the directness of pedestrian routes, discussed in further detail separately, the ease of crossing streets is very much determined by how often opportunities to cross are provided along them. The success of the improvements to Grand Avenue in East Lansing, which included midblock crosswalks, demonstrate the importance of this in improving walking conditions. The signalized midblock crosswalk on Rindge Avenue near Alewife Station in Cambridge represents a more expensive solution, while the signed-only examples from East Lansing show that a less expensive but effective option is available. Midblock crossings have the added benefit of slowing traffic and tying the two sides of a street together.

At intersections, do traffic signals serve the pedestrian?

To augment this question, one must also ask if crosswalks are provided and clearly marked, both at signalized and non-signalized (stop sign only) intersections. To be sure, the quality of signals can vary considerably. When long waits are involved, non-compliant behavior can jeopardize pedestrian safety. Kruckemeyer offers a way of achieving higher levels of service. However, simply providing well-marked crosswalks can vastly improve crossing conditions. Because these may be required anyway by today's more "enlightened" state Departments of Transportation and municipal Departments of Public Works (sometimes resulting in the rather ridiculous scenes of very wide, multi-lane highways that nonetheless do have crosswalks, although few if any users are actually there to use them) this really is not enough. Recognizing the special nature of the station area, the pedestrian routes within it should be designed for higher-than-normal usage and deserve enhanced features and attention, such as the signalized midblock crossing for the apartment dwellers near Alewife Station. A less expensive option involving little new infrastructure is the adjustment of traffic signalization cycling and phasing to allow more WALK time. Still cheaper are restrictions to vehicle movements—such as NO RIGHT TURN ON RED signs—that reinforce pedestrian routes and improve their safety. The elimination of right-turn slip lanes shortens crossing distances for pedestrians and slows vehicles.

4.5 Perception of Safety and Security

This section addresses an issue that is a concern throughout a transit trip, that of personal safety and security for pedestrians walking to stations. In this discussion, safety and security refer to a lack of criminal or disturbing activity and not to hazards posed by automobile traffic. The dangers encountered by pedestrians crossing streets are addressed in the previous section.

The decline of American public transit in the years following World War II—marked by decreasing ridership, under funded infrastructure and deferred maintenance—also meant an increasingly negative perception of the security of streetcars and trains. Reinvestment in older systems in the 1970s and '80s, as shown dramatically by the New York subway, has done much to dispel the perception that transit stations are unsafe and the attendant drop in crime confirms this. Moreover, new systems such as the WMATA Metro were built with an entirely new consciousness about designing for passenger security and safety. Openness and vandalism-resistant materials were some of the new features that have become standard today. New technology, including closed-circuit television cameras and emergency call boxes, also have improved the perception of security in rail vehicles and stations.

Unfortunately, while great strides have been made in making the system beyond the turnstiles and faregates a safe environment, the immediate surroundings of stations can often be places where people feel unsafe. In Caracas, Venezuela, the Metro is regarded a much safer place to be than almost any other public space of the city. While it is beyond the scope of a transit system to maintain security throughout the neighborhoods it serves, safe walking routes to stations are fundamental to walk-up access. While many factors contribute to a secure walking environment, they all relate in some way or another to three areas of concern: ample lighting of sidewalks and paths, orderliness and intactness of walking environments, and surveillance of pedestrian routes.

4.5.1 Ample Lighting

The quality and quantity of lighting is a very important consideration in the design of any transit system, especially one with underground stations and passages. The perception of safety in Chicago's subway stations has increased significantly with recent lighting improvements and a reflective whitewash of station walls. It follows that well-lit pedestrian access routes will increase safety and security, encouraging patrons who would not otherwise be inclined to walk to stations. Transit riders coming to and from stations by automobile in darkness, e.g. in the early morning or in the evening, are not much concerned by lighting. The vehicle provides a protective shell as it plies dark streets, and park-and-ride lots at stations are typically well-lit. The pedestrian, on the other hand, is confronted with those same dark streets, where it may be feared that strangers are lurking. Additionally, lighting provides the means for orientation and discerning obstacles and barriers that pedestrians may encounter. Even when streetlights are present and functional, they may not be adequate. Designed to light the roadway, they may leave sidewalks and other pedestrian areas in the shadows.

The previously referenced study of pedestrian access to WMATA's Orange Line stations revealed that the lack of lighting was a deterrent to Metro riders who parked their cars at the station but might otherwise walk. While such factors as the danger of auto traffic and the lack of sidewalks were cited much more often as reasons why they did not walk to Metro, nearly 13 percent of those surveyed overall indicated "inadequate lighting". This did not vary widely between the four station areas, but was highest for West Falls Church/VT-UVA Station (13.8%), which, as previously discussed, had few sidewalks in its environs. This suggests that the provision of sidewalks and adequate lighting are often related issues. When the "potential walkers" were isolated, the overall percentage jumps to over 43 percent, indicating that the degree and quality of lighting were definite concerns for would-be pedestrians. The study recommends that street lighting should be improved in dimly lit areas to provide for additional pedestrian security.

In another study, consultants of the City of Portland (Oregon) Office of Transportation sought to find ways to "improve transit use through pedestrian access". The 1997 survey of bus stops in the Rosewood neighborhood in northeastern Portland hoped to demonstrate that "a safer and more appealing pedestrian environment may increase transit ridership." This involved the identification of improvements and the evaluation of their effect on transit ridership after their implementation. The improvements included curb extensions, bus shelters, pedestrian refuge islands, new sidewalks and corner curb ramps, street lighting, and tree planting and landscaping. In pre- and post-construction 15-minute telephone interviews, researchers were able to conduct a fine-grained analysis of the impacts of the various elements. A positive, albeit weak, effect on transit ridership was identified: an overall 10 percent increase in transit trip making was found, though this figure was not statistically significant. The study report does indicate that "lighting improvements had a positive relationship; more pedestrian trips were taken by those who noticed the lighting improvements." The report also suggests that while transit ridership may not have dramatically increased, overall pedestrian activity—whether or not it was related to walking to the bus—had improved.

The findings make a stronger case for improved lighting when it is considered that the area "already had a fairly well-developed pedestrian network and facilities." This is, of course, not always the case with rail stations that are located in compromised locations. Bus routes, such as the ones serving the Rosewood neighborhood, can deviate from major arterials and serve neighborhoods and activity centers more directly than rail transit lines that are constrained to a certain alignment or corridor. In other words, given more adverse walking conditions—such as around the WMATA Orange Line stations—than in the Rosewood neighborhood, ridership could be expected to increase much more significantly with improved lighting.

4.5.2 Orderliness and Intactness of Pedestrian Routes

A subtler factor in pedestrian perception of safety and security lies in the orderliness and intactness of pedestrian routes. While well-lit pedestrian routes contribute relatively equally both to safety and security, well-kept and maintained facilities for pedestrians serve largely to increase their perception of security.

Safety is compromised when the surfaces of sidewalks and paths are defective: paving bricks or stones are missing, paving components separate, or are raised or lowered with respect to each other. Objects blocking the pedestrian path create similar problems. In these conditions, pedestrians are more likely to trip and fall and suffer injury, and the disabled may not be able to use these routes at all (see Figures 4.36 and 4.37). The same is true when snow collects or ice forms on walking surfaces. Enforcement of snow removal codes is an important part of maintaining pedestrian travel in northern climates. While it may not be possible to prevent the formation of ice, adequate drainage of the surfaces of sidewalks and paths is an important step toward that end, and will keep the path of the pedestrian free from puddles during warmer seasons. Objects protruding into sidewalks and paths also jeopardize pedestrian safety. This problem, however, can be addressed by attention to adequate sidewalk width, as discussed in a previous section.

Security, on the other hand, provides a much stronger motivation for keeping pedestrian routes orderly and intact. Pedestrians are more likely to worry about walking along a street strewn with trash and sprayed with graffiti than a street with gaps in or puddles on its sidewalks—though both send the message: "no one cares about or maintains these sidewalks; walk here at your own risk!" If an impression is given that no one is taking care of the area, the pedestrian may conclude that no one will care if she is threatened or accosted while walking through it. Whether or not crime is really a problem, it is this perception of insecurity that can prompt pedestrians to avoid walking in such areas (see Figures 4.38 and 4.39).

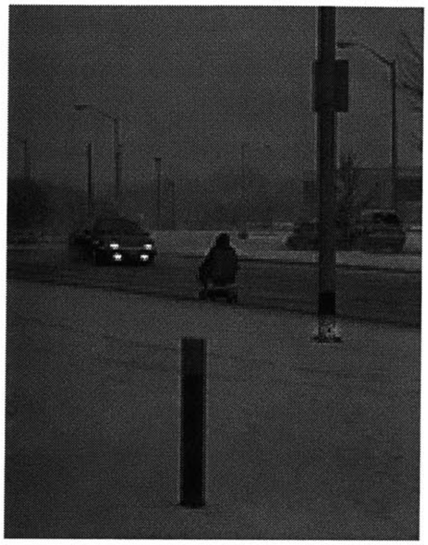

Figure 4.36 ***Wabash Avenue near Reisterstown Plaza Station***
Baltimore, Maryland

A wheelchair-bound Metro rider must make his way home from the station in the street because the sidewalks are not shoveled

Figure 4.37 ***Winchester Street near Fashion Place West Station***
Murray, Utah

Litter, poor pavement quality and obstructions discourage walking to the light rail station

Figure 4.38 ***Figure 4.39***
Along Alewife Brook Parkway near Alewife Station
Cambridge, Massachusetts

A sign indicating the route is "safe" would not be necessary if it appeared *safe...*

...graffiti farther along the route could be interpreted as an indication that it is not *safe*

A recent study of transit usage and pedestrian preferences in Chicago suggests that the subjective qualities of orderliness and intactness do figure prominently in the minds of the walking public. Among several station attributes, "cleanliness" (meaning that the station interior and exterior have no litter or graffiti) was found to have a moderate value to the patron of almost three cents per trip. While not as valuable as attributes such as weather protection and lighting (around four cents), it is more important to riders than noise reduction or landscaping (somewhat less than two cents).[28] The same study found that cleanliness was among the most variable of the qualities, possibly reflecting the fact that some stations are perceived as more clean than others.[29] Patrons already satisfied with the conditions in the stations they enter and exit the system at are likely to rate this as less important, while the dissatisfaction of others at the stations they use would cause them to value a litter- and graffiti-free environment more highly. The study found that those who placed a very high value on cleanliness and related attributes were predominantly female, older, and frequent transit riders.[30] This is not surprising, and calls for increased attention to the orderliness and intactness of pedestrian routes in areas frequented by a high proportion of women or the elderly.

Perhaps the strongest argument for orderliness and intactness along pedestrian routes is the often-observed phenomenon that the disorder of graffiti, vandalism, and ill-maintained facilities invites further such abuse. While the message "walk at your own risk" deters pedestrians, it in turn invites would-be criminals and vandals: "here you can get away with crime." Small acts of damage and disorder, if left unchecked, can quickly spiral out of control and become more serious problems. Because of this, transit authorities have adopted a "zero tolerance" policy for graffiti. A marked vehicle is immediately taken out of service so that further abuse is not encouraged. A similar approach is often taken in the case of stations; unfortunately, however, pedestrian routes to stations typically lie outside a transit authority's jurisdiction. Along pedestrian routes en route to stations where the problems of litter, graffiti and lack of maintenance exist, a

[28] RSG 2000, 10
[29] RSG 2000, 14
[30] RSG 2000, 18

transit authority can pursue a relationship with a city government, Department of Transportation or a business improvement district to address them.

Compounding the complications involved with the multi-jurisdictional nature of maintenance issues is their very nature. "Operating costs", under which maintenance may be classified, are often viewed very differently from the capital costs of construction. Public works projects tend to be top-heavy in this regard, where attention and resources are focused on construction while sufficient regard to what will happen to facilities after they open for public use is often neglected. Unfortunately, well-maintained sidewalks and paths will not attract pedestrian access to transit stations so much as such facilities in disorder and disrepair will discourage it. Because orderliness and intactness are subtle qualities, fall under many jurisdictions, and require "operating" rather than "capital" costs, it is easy to neglect them. To face these difficulties, cooperative relationships between transit authorities, cities, and other agencies would help. Identifying who is responsible for what is a first step. But to begin with, facilities for pedestrians should be designed so that they will require as little maintenance as possible: surfaces should be easy to clean and graffiti-proof; materials should be robust, even if they cost more up-front; and design and construction methods proven to hold up well over time should be used whenever possible. Elements should not invite vandalism, and waste receptacles should be available at frequent intervals to contain littering. This approach offers the best prospects for keeping pedestrian routes orderly and intact.

4.5.3 Surveillance

The previous two sections have dealt mainly with physical qualities that affect the pedestrian's perception of safety and security. Aside from a need for well-lit and well-maintained pedestrian routes, these must also offer the walking public some form of supervision, an action that must be performed. This section reviews physical attributes that contribute to surveillance, as well as a discussion of passive and active forms of supervision.

Of course, surveillance is aided by certain physical conditions. Pedestrian routes in open areas with direct lines of sight between streets and other regular intervals are much more likely to give pedestrians the sense that others can see them, should their safety or security be threatened. The orientation of buildings, their uses, and the amount of activity within them either contribute to or detract from the sense of security. Buildings set far back from the street separated from sidewalks by large parking lots provide no opportunity for visual dialogue between individuals indoors and those walking by. Homes and storefronts brought up close to the street, however, can give passersby the sense that others are around and are casually observing what is going on outside. Warehouses and other industrial uses may offer only a blank wall to the street, while sidewalk cafés blur the distinction between inside and outside, placing people right along the sidewalk where they casually observe pedestrians walking by.

While these physical attributes may increase security and reduce crime, it is difficult to measure how they affect the perception of security. Writing about how the streets of New York City have become safer in the late 1990s, writer Matthew Cowan suggests that this change has been brought about by several factors—a decline in the crack trade, a booming economy, a higher birthrate—and, people "believing they were safer". He cites that one of "the most important contributors to this social paradigm shift is perception, which, to a large extent, determines reality."[31] This perception was perhaps articulated best by Jane Jacobs in the 1960s, who attributed the security of the streets in her Greenwich Village neighborhood of New York City to "eyes on the street". The windows of buildings lining the streets amounted to so many dozen eyes providing casual surveillance of the activity before them. But Jacobs emphasized that the eyes of other pedestrians play an even greater role, for they not only infer but actually confirm that the street is being watched, but also the very activity of pedestrians attracts people within buildings to watch what is happening outside:

> "...the sidewalk must have users on it fairly continuously, both to add to the number of effective eyes on the street and to induce the people in buildings along

[31] Cowan 2000, 2

> the street to watch the sidewalks in sufficient numbers. ...Large numbers of people entertain themselves, off and on, by watching street activity.[32]

Pedestrian activity, as a key component of urban vitality, will be discussed further in section 4.7.1. Active pedestrian activity provides passive surveillance promoting a sense of security, encouraging even more walking.

More active forms of surveillance include closed-circuit cameras, a police presence, and emergency callboxes. In cities of the United Kingdom, closed-circuit television has been instituted widely to monitor public streets. Areas identified as having "significant crime and disorder problems," as well as crime "hotspots" in areas with lower absolute levels of crime are outfitted with cameras.[33] Not surprisingly, many have reacted rather unfavorably to the feeling that "Big Brother" is watching. Ironically, the presence of police can likewise be unsettling. While the presence of other pedestrians can send a positive message about the level of security, police and security officers can send the opposite message: "police are here, so this generally must not be a very secure place to be."

A subtler, though less immediate way of providing police services is through emergency callboxes, which are common within transit vehicles and stations and on the campuses of large institutions, such as universities. "Police presence" and "cameras" figured prominently in the study of station improvements for Chicago's rapid transit lines discussed in the previous section. Both qualities were valued at nearly four cents a trip, greater than all other improvements except weather protection, elevators and escalators, and lighting.[34] As with "cleanliness", a high degree of variability was found for "police presence" and a moderate one for "cameras".[35] It is likely that in areas with higher rates of crime (or a greater perception of insecurity) these qualities would receive a higher rating, while in more secure areas a lower rating is assigned. Interestingly, survey respondents who "never" or "almost never" use CTA rapid transit placed a higher value on both

[32] Jacobs 1961, 35
[33] Home Office 2001
[34] RSG 2000, 10
[35] RSG 2000, 14

qualities.[36] This would indicate that there is a perception of transit stations being unsafe. If these individuals used the system even occasionally, they would likely find it more secure than they believed it to be and would place a lower value on a police presence or cameras. Demographically, those who placed a high value on these qualities tended to be younger and more female than average.[37] Pedestrian routes in areas with greater proportions of young women—college campuses, for example—might benefit from a police presence or camera surveillance.

The Chicago study's focus was on rapid transit stations themselves, which typically are underground, above street level or in expressway medians and therefore out of sight of streets or neighborhood buildings. Thus it follows that a police presence or cameras (active surveillance)—in lieu of "eyes on the street" (casual surveillance)—would be desirable in those isolated location. Active surveillance in areas where casual surveillance is perceived may do more harm than good. Even in situations where subtle means of active surveillance are provided—as is an emergency alarm at the edge of a park in the approaches to Alewife Station in Cambridge, Massachusetts—casual surveillance would likely do more to lend a perception of security (see Figure 4.40). No homes or businesses look out onto the west end of the park nearest to the station, a condition that probably prompted the installation of the callboxes in the first place. Redevelopment of parcels surrounding the station, on the other hand, would provide "eyes on the pedestrian routes" at the same time as generating more pedestrian traffic to and from the station. Increased pedestrian activity in the area would provide a high perception of security. Were this the case, emergency callboxes would hardly be necessary.

[36] RSG 2000, 17
[37] RSG 2000, 18

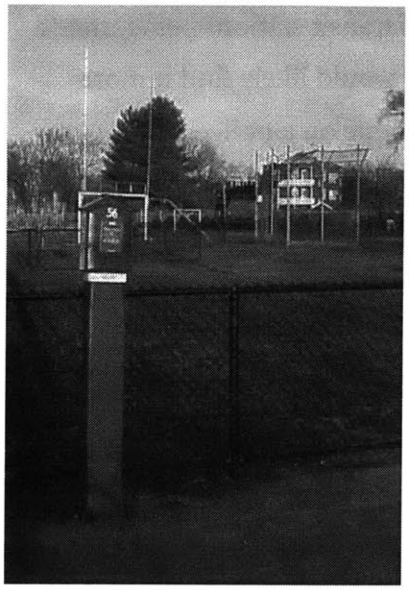

Figure 4.40

Emergency alarm near the east entrance to Alewife Station Cambridge, Massachusetts

Surveillance of pedestrian routes is an important component of inducing a high perception of safety and security to encourage walking. The most effective and inexpensive means to provide this is through the activity of other pedestrians and of people going about their daily activities along a pedestrian route. Thus the combined effects of other factors encouraging walking are likely to produce better results than specific interventions such as police patrols or cameras along streets and paths leading to stations. However, in situations where crime persists or pedestrian activity has yet to gain ground, these interventions may be necessary to provide pedestrians a sense of security as they walk to and from transit stations.

4.5.4 Guidelines

Pedestrians are subjected to greater feelings of vulnerability than are automobile drivers and passengers. For walking to be encouraged, environments around stations need to impart a sense of safety and security. Lighting, maintenance, and surveillance of pedestrian paths do much to meet this end.

Is there sufficient lighting of pedestrian routes to stations?

Adequate lighting is fundamental to imbuing a perception of security and safety among pedestrians. Lamps designed to light streets may not provide the pedestrian-scaled lighting necessary for sidewalks and may need to be augmented or redesigned. It is essential that off-street pedestrian paths be lighted. Walls and other structures along pedestrian routes in dim locations—such as in tunnels or under bridges—can be painted or tiled in light shades to reflect light. Care must be taken, however, not to introduce an uncomfortable glare. Just as with stations themselves, the best form of lighting is always natural daylight, and should be provided whenever possible.

Are pedestrian routes orderly and intact?

Great strides have been made in recent years at keeping the nation's transit infrastructure clean and free of graffiti. This standard must also extend beyond the confines of stations to include pedestrian routes feeding them. High-quality and durable components can keep future maintenance, difficult to fund and continue consistently, minimal. However, a program must be in place to ensure that superficial problems like graffiti and litter, as well as more fundamental problems such as sidewalk deterioration and disintegration, are never left unattended to the point where they attract crimes and permanently deter pedestrians.

Is some form of surveillance present along pedestrian routes?

People will walk and feel safe and secure where others are walking. Thus all means to improve pedestrian access can contribute to providing casual surveillance. Routes populated with activity—lined with storefronts, offices and residents—also provide "eyes on the street". Where security is of greater concern, or levels of activity are currently low, it may be necessary to provide a police presence or monitoring by closed-circuit television. These rather costly interventions should be chosen carefully, as they may have the undesired effect of intimidating would-be pedestrians.

4.6 Provision of Identification and Information

This section discusses needs of a conceptual nature—that of providing identification of transit stations and information about their surroundings. At a bare minimum, some form of system identification and information, as in the form of signage, is essential for a transit system to be useful at all. For it to be truly effective, however, a complete program of consistent and well-designed identification and information-providing elements is necessary. Such a program addresses the significant informational needs of first time users as well as contributes to expanding the frequent user's knowledge of the system and the destinations that she can reach with it. Riders need to find their way to the system, from the system to their final destination, and what is along the way. If successful, such a program builds the confidence of transit riders—contributing to a "mental map" in the minds of users of the system and where it is able to take them. A recent Project for Public Spaces, Inc., (PPS) study for WMATA concludes that "enhancing...existing signage and information, and adding additional information in appropriate locations...will...turn the Metro into a system of destinations, not just stations."[38] In the end, transit riders are not trying to reach stations, but destinations, and the last leg of this journey can often be on foot.

4.6.1 Internal Station Identification

Providing information to assist pedestrian travel beyond the immediate surroundings of a station begins well inside it. This begins with the station name. Station names can be limited to a specific street or may even represent an entire city. While brevity is a concern, station names that offer as much information as possible about their surroundings are more helpful to pedestrians. For instance, a station named after a street may give the impression that only that street is served—unless an entire neighborhood identifies itself by that street. Using the MBTA rapid transit system as an example, "Downtown Crossing" is more all-inclusive than the former name, "Washington" (for Washington Street).

[38] PPS 2000, 1

However, "Central" is named after Central Square, yet an area larger than the square in the heart of Cambridge associates itself with the name. In any case, a name that reflects an entire neighborhood or community—that is, the entire area within walking distance—is preferable. In recent years WMATA has expanded the names of many of its Metro stations to include additional references to their surroundings (see Table 4.1 below). This has reinforced the opportunity for pedestrian access to the named institutions, attractions, and neighborhoods. Consistently appearing on all system maps and signage, the expanded names make metro riders aware and instill in them confidence that the destinations named can be accessed on foot.

Table 4.1 Expanded Names for WMATA Metro Stations

Original Station Name	Current Station Name
Addison Road	Addison Road-Seat Pleasant
Archives	Archives-Navy Mem'l
Ballston	Ballston-MU
Brookland	Brookland-CUA
Dunn Loring	Dunn Loring-Merrifield
Gallery Pl	Gallery Pl-Chinatown
Grosvenor	Grosvenor-Strathmore
Mt Vernon Sq	Mt Vernon Sq/7th St-Convention Center
U St/Cardozo	U St/African-Amer Civil War Memorial/Cardozo
Van Ness	Van Ness-UDC
Vienna	Vienna/Fairfax-GMU
Waterfront	Waterfront-SEU
West Falls Church	West Falls Church-VT/UVA
Woodley Park-Zoo	Woodley Park-Zoo/Adams Morgan

Because station interiors usually do not offer a good view of the surrounding area, if at all, they can be very disorienting. Along with signs bearing the station name, other elements can begin to give the transit rider cues about what he can walk to once he has reached the street above or below the station. The work of Cambridge Seven Associates to guide the modernization of the MBTA rapid transit lines in the late 1960s illustrates several important concepts. One device was intended to orient riders to the direction they face as they walk toward the ends of station platforms. Walls at the inbound end were colored in red and yellow vertical stripes, symbolizing the activity and lights of the city, and those at the outbound end received the same treatment in blue and green, symbolizing the greenery of suburban areas. Newer stations have not carried on this orientation device, suggesting that it has been less than successful. The "inbound" and "outbound" directions are unfortunately not always clear from station to station, and the colored striping conflicts with the color-coding of individual lines.

A more successful idea was the use of large photomurals on enameled panels on platform walls offering clues about the streetscape and attractions within walking distance to be found below or above the station (see Figure 4.41). The PPS study recommends this idea for WMATA's Metro, whose stations "resemble one another to the extent that some passengers find it difficult to tell them apart at platform level."[39] Based on the success of similar efforts in European cities, the use of neighborhood-related artworks is also suggested:

> Use artworks commissioned by or donated to WMATA as neighborhood orientation features and local landmarks, to convey to passengers features about the neighborhoods and districts surrounding each station.[40]

A further device identified in the study to connect station interiors with the neighborhoods around them would be to "allow community groups to program

[39] PPS 2000, 1
[40] PPS 2000, 20

[dynamic passenger information displays] in their neighborhood stations to promote upcoming civic events and celebrations."[41]

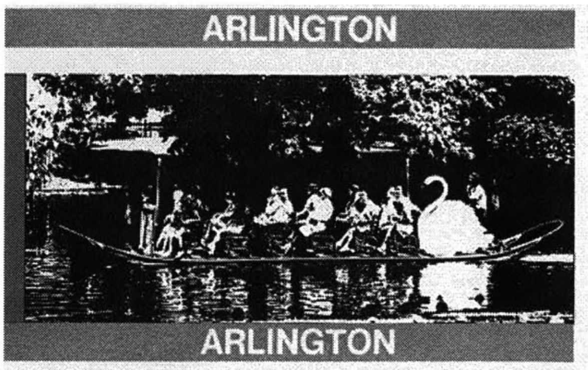

Figure 4.41 ***Arlington Station***
Boston, Massachusetts

Photomural makes connection to streetscape above the station

Another component of the Cambridge Seven work was a new system of consistent signage. Especially when there are multiple station exits, signs on the platform can already indicate which exit is the most convenient to use in order to reach particular streets or destinations. Even when there is only one exit, signs can indicate what streets it is nearest to. Many compromised stations are designed primarily as park-and-ride and bus transfer facilities, and this is reflected in the signage. West Falls Church/VT-UVA Metro station, described in detail earlier, is one such example. Signs above the stairs and escalators leading from the platforms point the way toward "Buses", "Kiss & Ride", and "Parking", but no reference is given to any streets or the destinations near the station, including a university extension center that is now part of the station name (see Figure 4.42).

[41] PPS 2000, 11

Figure 4.42 ***West Falls Church/VT-UVA Station***
Fairfax County, Virginia

Signage directs exiting passengers to buses, parking and the kiss-and-ride, but not to any streets or surrounding points of interest

The PPS study identifies this as a common problem throughout the Metro system:

> When exiting a train, it's not clear which exit one needs to take to get to reach one's destination. Station exits are not named after destinations. The destinations that are listed are not the ones that one sees upon exiting, and few include the street name or intersections.[42]

Besides representing a failure to provide comprehensive information, this sends a subliminal message that pedestrian access is not intended nor accommodated. The PPS study recommends, as a medium term intervention, the installation of "street name signage at escalator entrances at the mezzanine level. This could [also] be located on the sidewalks of the station entrance. At least the names of the immediate cross streets should be provided as well as the geographical orientation."[43]

4.6.2 Station Area Maps

Station area maps placed both within and outside stations facilitate pedestrian access by showing the streets, institutions, and attractions that are within walking distance. When part of a consistent program implemented throughout the transit system, such maps encourage confidence in pedestrian access. For first-time system users, station area maps

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[42] PPS 2000, 11
[43] PPS 2000, 28

are indispensable, but even frequent users sometimes make trips to unfamiliar stations. Knowing that wherever one travels on the system, an area map will be waiting to guide the final leg of the trip helps to encourage non-traditional tripmaking outside of the daily commute. It should be noted that existing street maps may not be sufficient for use as station area maps. A consulting firm has recently designed a pedestrian-oriented street map for a town in Germany. Recognizing that "public transportation and pedestrian travel are inseparable," information about transit is included as well as features not always found on ordinary maps: pedestrian paths and trails as well as symbols for safe street crossings, public restrooms and telephones.[44]

In the station renovation study conducted in Chicago, "information and maps of neighborhood and attractions at stations" was one of the features of a "modernized" station compared with others according to relative value. Overall, surveyed respondents valued "maps and attraction information" at nearly three cents per trip—about the same as "cleanliness". The study notes that "while this value might vary among types of travelers, overall there is a moderate value from this relatively low-cost feature."[45] Interestingly, riders using Chicago's rapid transit "frequently" valued maps and attraction information the same as those who "never/almost never" use it, with occasional riders rating it as slightly more valuable.[46] This indicates wide agreement that these elements are an important transit system component.

Cambridge Seven included station area maps as part of its graphics program for the MBTA system modernization. The consistent application of a series of information panels appearing both on platforms as well as mezzanines greatly improved orientation for transit riders: a stripe in the color of the line is found at the top and bottom, with the station name reversed out in white. Below the top band is directional information, to be read once a passenger has reached the platform. In between the two bands are the station area map, a system map, a list of the stations served by trains stopping at the platform and indicating transfer possibilities, and finally the large photomurals previously described

[44] _____ 2000 *Nahverkehrspraxis*, 47
[45] RSG 2000, 12
[46] RSG 2000, 17

(see Figure 4.43). Unfortunately the station area maps are executed in enamel, which makes them durable yet expensive to replace. As a result, the maps are now very outdated and do not reflect the many changes that have taken place during the past thirty years.

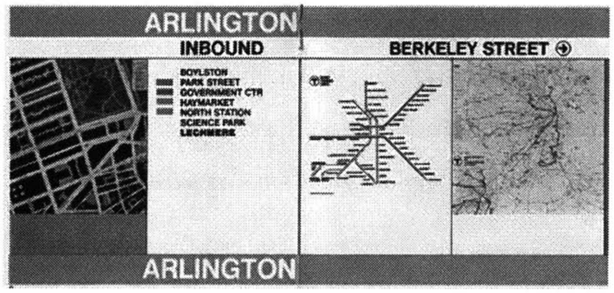

Figure 4.43 *Arlington Station*
Boston, Massachusetts

Station area maps are provided on the mezzanine and platform walls at many MBTA rapid transit stations (far left)

WMATA pursued a more flexible option with paired vitrines on station platforms and mezzanines that allow system maps and station area maps to be replaced as necessary. The maps feature a high standard of graphic design and their consistent appearance, scale and installation in every station in the system is unmatched by any other transit system in the U.S (see Figure 4.44). However, while system maps have been updated with each of the growing system's new line openings, the station area maps appear to remain static. Additionally, the PPS study identified several additional shortcomings: too "few neighborhood maps along the station platforms [which do not indicate] local, neighborhood area destinations"[47], they are not "located near the base of entranceway escalators to help departing passengers make their intermodal connections or find their way to their destination."[48] As a short-term intervention, the study recommends the placement of the system and neighborhood map pairs near the base of each bank of escalators on platforms, aiding passengers as they make their way out of the station. Conversely, the same maps should "greet passengers upon entering a station," as is the case, the study notes, at every New York City subway station.[49] They are then available in both the free and paid areas of the station.

[47] PPS 2000, 11
[48] PPS 2000, 24
[49] PPS 2000, 25

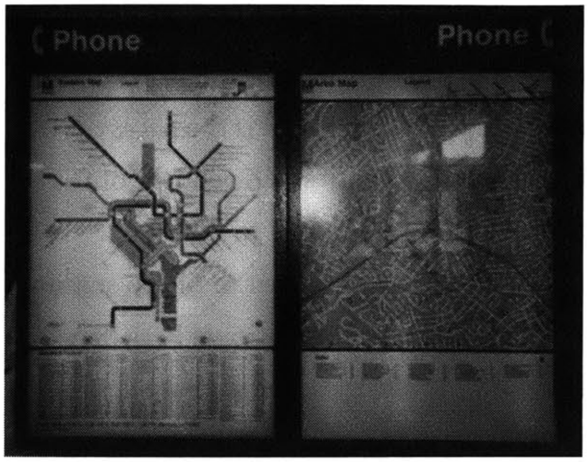

Figure 4.44

Station area maps (right) appear next to a system map (left) in all WMATA Metro stations

Project for Public Spaces, Inc.'s recommendations to WMATA are already featured in the metro serving metropolitan Bilbao in Spain. Vitrines are placed perpendicular to station entrances, headed with a backlit, red band identifying the station by name and composed of four panels: the stylized metro system map, a district/neighborhood map, a station plan and a timetable/information panel (see Figure 4.45). A large amount of information is provided, but the consistency of its presentation—the same at every station entrance—enables riders to quickly find as much or as little information as needed. Identical vitrines line the platforms below, making orientation within the metro and its surroundings consistent and easy.

Figure 4.45 ***Moyua Station***
Bilbao, Spain

A sequence of vitrines, including a station area map, are found at the entrance to each metro station; the identical sequence is found on the platforms below

Metro Bilbao's station area maps were conceived as part of the system from the outset. In already-established systems, outfitting all stations with a complete set of maps and information-providing elements represents a considerable expense, as is the necessary updating and maintenance. These costs could be shared by entities independent of the transit authority. Efforts of organizations outside WMATA have helped to fill the informational gap, placing neighborhood maps on the surface adjacent to Metro station entrances: the Downtown DC Business Improvement District, the National Park Service, and various cities and counties (see Figures 4.46-4.48). While these efforts have certainly made using Metro easier for pedestrians, their small scope (in each case, only one or a few stations is involved) and, despite a high level of individual design quality, their inconsistency in presentation, colors, and scale makes them less effective than posting the consistent station area maps found within the stations at these locations would be. However, outside entities are in the best position to implement wayfinding systems to guide transit riders from stops to particular destinations. They have a vested interest in guiding their patrons from the stations to their doorsteps, and the transit authority avoids accusations of favoritism.

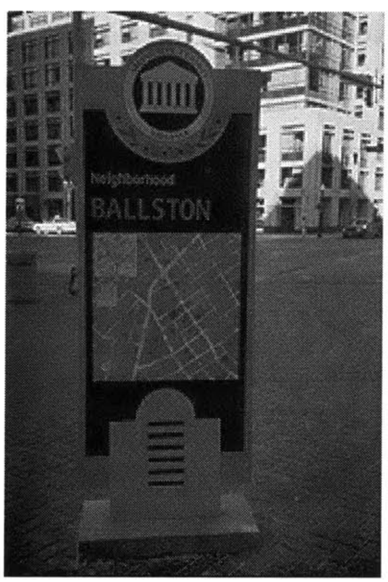

Figure 4.46

Station area map
at Ballston-MU Station
Arlington County, Virginia

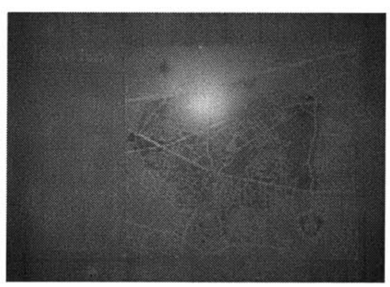

Figure 4.47

Map of the City of Fairfax
at Vienna/Fairfax-GMU Station
Fairfax County, Virginia

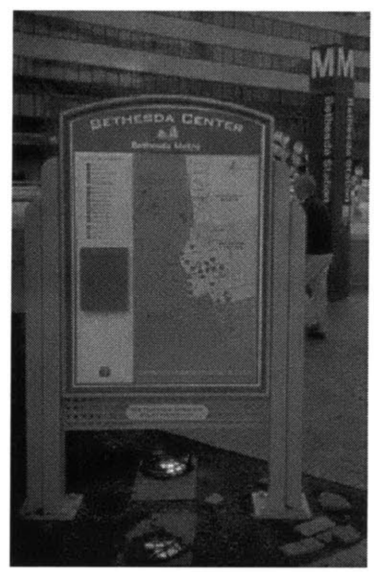

Figure 4.48

Station area map
at Bethesda Station
Montgomery County, Maryland

One of the best examples of an outside party's efforts to provide information for pedestrians using transit is the publication of *StationMasters*, a pocket-sized guide that features maps of every WMATA Metro station showing the surrounding neighborhood within a half-kilometer (one-third mile) radius. The maps are quite detailed, showing educational and government institutions, hotels, libraries, hospitals, museums, parks, post offices, churches, shopping centers and theaters, all indexed. WMATA has begun to offer copies of individual station area maps along with its own informational brochures at station kiosks. This arrangement is mutually beneficial—WMATA is able to provide additional, take-along information that assists pedestrians, while the guide's publisher enjoys widespread advertising for the full publication. Unfortunately, they are not consistently available at all stations, and their design does not match Metro's other maps or information-bearing materials. Presentation and an image consistent with Metro's well-defined graphics standard would be more effective.

4.6.3 External Station Identification

While the lack of station area maps at entrances is a missed opportunity to aid pedestrians making their way *from* the system, insufficient identification of the station in the streetscape hinders walk-up access *to* the station. In the auto-dominated environments of many station areas, particularly those in compromised locations, advertising and identification signage for businesses and institutions are on a large scale and designed in styles and colors to attract the attention of motorists driving by at speed. Transit systems, with their often minimal and nondescript identification devices, typically fade into the background.

Prior to the work of Cambridge Seven, the Boston area's rapid transit lines had no unified identity. The architectural firm "conceiv[ed] the problem to be one of urban design...suggest[ing] that a city's transit system forms its structure." They aimed "to make this structure quickly comprehensible to the passenger and to provide him with means for orientation within this structure."[50] The most powerful achievement of this effort was the adoption of a modified letter "T" in a circular white field as a symbol for the MBTA's services, particularly its rapid transit lines. Patterned after the successful use of a one-letter symbol/icon used in other cities to indicate rail transit (such as "M" for metro, "U" for *U-Bahn* in Germany, and "T" for *Tunnelbana* in Sweden), the "T" was meant to loosely stand for the words "transportation", "transit", "tunnel", "travel", all of which are associated with the system. Illuminated signs with the distinctive, circular "T" symbol replaced inconcise, cluttered, or nonexistent signage to identify stations (see Figures 4.49 and 4.50).

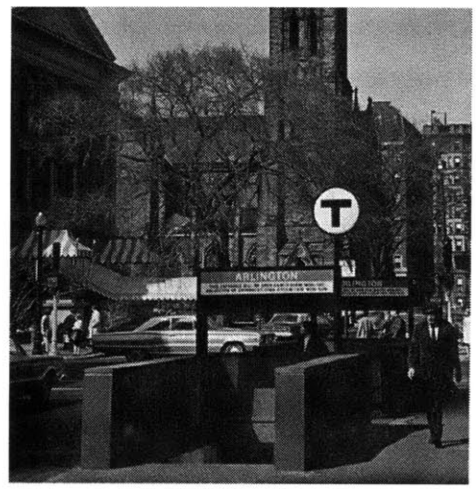

Figure 4.49 ***Figure 4.50***
The 'T'—a new identity for the MBTA's rapid transit system

Old inconcise, inconsistent signage was replaced...

...with a consistent, instantly recognizable symbol

At about the same time Cambridge Seven was at work on the MBTA station renovation project, the Washington Metro was also being designed. The system's architects, Harry Weese Associates (HWA), embarked on a whirlwind trip through Europe prior to developing the initial design concepts, evaluating the success of the subway systems there. The huge, ornate entrance buildings they encountered in Leningrad and Moscow were

[50] Institute of Contemporary Art 1967, 3

found contradictory to what was foreseen for Washington. HWA decided to take a different, minimalist approach: no imposing entrances to compete with the monumental works the stations would be situated next to. Indeed, no enclosures were to mark the stations at all, with a simple parapet around the escalators, uncovered and open to the sky. Only the newest of the stations, opened on the final two segments of the system, have covered entrances. From a distance, the only means of identification is the system identification pylon that consistently appears at every station entrance. Of uniform size and executed in bronze, the pylon is erected on strategic sight lines and bears on each side a backlit system symbol (an "M"), stripes indicating the colors of the lines serving the station, and the name of the station positioned on the vertical axis.

While this design philosophy is admirable and convincing, it is simply too meek. The PPS study notes: "the 'M' pylon is not readily visible from all paths of approach,"[51] "the lack of identifying signage, such as the prominent display of the station name anywhere besides the pylon and the bottom of the interior escalator parapet was a problem at all the stations studied," and "many station escalator parapets were difficult to discern as Metro entrances because they are surrounded by newsboxes [or] hedges...and no other signage exists, save the pylon, to identify it as a station."[52] Suggested remedies include the addition of lighting to the station exteriors and the station name to the exterior of escalator parapets, as well as the construction of canopies over the entrances, which are now under design and will be retrofitted at all stations.[53] The study notes a further deficiency:

> ...the lack of public/private agreements to allow for the display of Metro signage on non-Metro property conspire[s] to perpetuate a missed opportunity for providing Metro passengers (especially first-time or infrequent users) with the basic information required to enable them to plan and embark upon their Metro journey safely, conveniently, and with confidence.[54]

It is desirable to have identification signage, consistent with that found directly at station entrances, at locations short distances away. This is especially useful in the case of

[51] PPS 2000, 44
[52] PPS 2000, 45
[53] PPS 2000, 48

"compromised" stations, as these are located some distance away from origins and destinations. Fisher and Radisch recommend that even when a transit station is above or below grade, "there should be a physical response at street level...that 'reads' as an important place, for motorists and pedestrians."[55] Pylons and signs can be placed at nearby intersections, pointing the way to the station entrance (see Figure 4.51). Also, when the pedestrian routes to the station go under or over a bridge, or through a building or other structure, the system signage can mark the "points of entry" and direct the way to the station, even when it is still some distance away. By the same token, these signs can also point the way to destinations, streets, and intersections for the benefit of pedestrians walking away from the station.

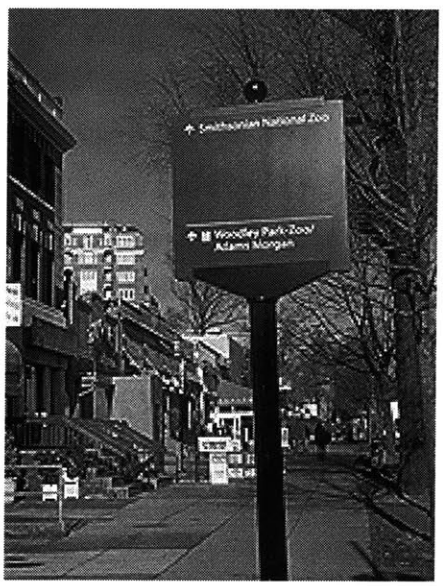

Figure 4.51
near Woodley Park-Zoo/Adams Morgan Station
Washington, District of Columbia

The Downtown DC Business Improvement District has installed wayfinding signage around many Metro stations

Dynamic passenger information systems at "points of entry" are a particularly attractive amenity. Real-time information displays indicating the number of minutes until the arrival of the next train were introduced on the platforms of light rail stations in Stuttgart, Germany, in 1993, and have been operating in WMATA Metro stations since 2000. Customer service messages can be programmed for display, and timely information on service irregularities can be provided quickly and efficiently. After the initial success of

[54] PPS 2000, 40
[55] Fisher and Radisch 1995, 22

Stuttgart's dynamic passenger information program, it has been continually expanded and displays have been installed in the mezzanine levels and at the entrances to underground rail stations. One of the most successful applications has been the display at the entrance to a busy station deep underneath the city's main pedestrian mall. Before descending to catch a train, a passenger can see if she has enough time to buy a newspaper or continue window shopping a little bit longer. Avoiding an uncertain and tedious wait on the platform below, this adds much to the attractiveness of riding transit. In the case of "compromised" stations, dynamic passenger information displays in areas of activity separated from the station can create a stronger link between transit and surrounding origins and destinations.

The Bilbao Metro is also exemplary with respect to external station identification. To provide a clue about the existence of the station below and an instantly recognizable "icon", Sir Norman Foster, the system's architect, designed station entrances composed of stainless steel and glass in an elliptical form. The shape echoes that of the cavern below, itself an ellipse, while providing shelter and enclosure. By day, the entrances are transparent to the activity and traffic around them; by night they act as "lanterns" drawing further attention to the metro and issuing forth a welcoming glow to those who enter and descend to the station below. The uniqueness of these entrances—an accomplishment comparable to Hector Germain Guimard's *libelulles*, the art nouveau entrances to the Paris Métro—has generated a sort of affection among Bilbaoans, who refer to them as "*Fosteritos*" (see Figure 4.52). Augmenting the *Fosterito*'s street presence is a tall, stainless steel mast topped by the icon/corporate logo of the metro, which announces its presence from afar. While an architectural statement is not necessary to identify stations, it can be very effective in imbuing a positive image and strong associations among the public. Distinctive and attractive signage and symbols can draw pedestrians in toward the stations, inspiring confidence that they are walking in the right direction and advertising the system, even prompting "impulse" transit journeys.

Figure 4.52 ***'Fosterito' Metro Entrances***
Bilbao, Spain

Distinctive architecture helps identify the station in the streetscape

4.6.4 Guidelines

Providing identification of transit stations and information about their surroundings encourages pedestrian access to stations. Prominent markers, symbols and distinctive architecture identify stations from afar. Detailed signage within stations guide pedestrians to their ultimate destinations, and station area maps inform all riders of what is within walking distance. The following guidelines apply to these elements:

Does signage within stations identify destinations within walking distance?
The name of the station itself provides clues about destinations pedestrians can reach from it. The use of a single street or intersection as the station name often limits the perception of the area that the station serves. A name reflecting an entire neighborhood or community, or incorporating the names of a few of the most important pedestrian-accessible destinations, is preferable. Signage directing egress from the station platforms should name the streets and buildings immediately served by the exit(s), and indicate the direction of streets and destinations farther afield toward which pedestrians are likely to be headed.

Are station area maps posted within stations and at station entrances?
Station area maps on the platform and mezzanines provide orientation and help pedestrians choose the exit most convenient for continuing their journey. Maps at station entrances offer the same information in unpaid areas and allow transit patrons to relate map-based information to the streetscape and surroundings they see at the entrances, helping them to choose the best route to their final destination. Outside parties may play a role in the installation or sponsoring of such maps, as well as wayfinding systems designed to guide pedestrians to particular destinations.

Are station entrances well-identified in the streetscape, with additional signage at distances farther away within the station area?
Signage and symbols identifying transit stations must compete with the other signage, advertising, and activity of streetscapes. While entrances themselves can, through their architecture, aid pedestrians in locating them, liberal placement of consistent signage at points of activity (major intersections) or points of entry (where pedestrian routes enter buildings, bridges, or tunnels that lead to the transit station) contributes to confidence in pedestrian access to the transit station.

4.7 Urban Vitality

The final of the six major components contributing to pedestrian-friendly station areas is urban vitality. It is discussed last because it is a *condition* that cannot simply be planned and implemented, as certain interventions involving the other five qualities can. The elements conducive to a vital urban environment can be created, but do not guarantee that it will develop. There is great promise in pursuing urban vitality, however, because once it has been realized in a station area, walking will tend to predominate as the preferred means of travel.

Station areas with urban vitality are typically sited at the center of attention—in a traditional downtown or other mixed-use activity center. The compromised station represents the other extreme—a station removed from such pedestrian "hot spots" or in suburban locations where urban vitality simply does not exist. Efforts to introduce an active public environment in these areas generally involve a "reaching out" of nearby, existing development to incorporate a station into its fabric, or focusing development around the station to create a fully new node of activity. In each case, some degree of improving the *density*, *diversity* or *design* of development is involved. A *density* of origins and destinations within walking distance creates pedestrian activity. This is supported by a *diversity*, or mix, of pedestrian-oriented uses. Walking is further encouraged by pedestrian-oriented *design*. These characteristics are accepted as the basic elements of transit-oriented development and are described in detail in this section.[56]

4.7.1 Pedestrian Activity

Active pedestrian routes define active neighborhoods, and depend on a degree of density in the development surrounding them. For example, foot traffic is much more readily observed in the employment centers of traditional downtowns than in suburban office parks. While a number of other factors are involved—including the ease of crossing streets and others previously described—low-rise buildings separated by vast empty areas used as parking lots or open space simply have fewer workers and destinations per unit area than higher density buildings sited next to one another. In the former situation, the number of potential pedestrians and potential walking trips is inherently lower, as is potential transit ridership. Studies have found that a 10 percent increase in population densities was attended by an increase of about 6 percent in boardings at light rail stations.[57]

When few others are walking, the pedestrian tends to feel exposed and uncomfortable.

[56] Deeming 1998, Abstract
[57] Bernick and Cervero 1997, 75

As discussed earlier in section 4.5, pedestrian activity is a key component of providing a sense of security and safety along pedestrian routes. Other pedestrians cast additional "eyes on the street" that discourage criminal activity and render otherwise foreboding areas less threatening. By the same token, people enjoy casually watching other people, as Jane Jacobs observed.[58] Thus pedestrians attract additional pedestrians, developing a reinforcing relationship.

The Chicago Department of Transportation transit station renovation study referenced in previous sections found evidence supporting this. One of the "features" of an enhanced station in the study is an "active neighborhood." Survey respondents were presented with two opposing qualities, "station area is a BUSY neighborhood or retail area" or has "little activity and some empty buildings or lots". An "active neighborhood" reflecting the former condition was found to represent a moderate improvement, valued overall at nearly three cents per transit trip and slightly higher than "cleanliness".[59] This would suggest that, just as station cleaning is considered a fundamental part of transit operations and maintenance, similar attention should be given efforts to increase neighborhood activity around stations.

Increasing pedestrian activity around stations may be especially helpful in attracting new riders. Among the fourteen qualities in the study, there is a greater positive differential in the valuation of an "active neighborhood" between those who "never/almost never" use rapid transit and those who "frequently" or "occasionally" do so.[60] Suggestive of the correlation between activity and perception of security, those who tended to value an "active neighborhood" more than other qualities also rated lighting, cameras, and police presence more highly. These respondents are slightly younger and more female than average, so efforts to increase neighborhood activity would be especially effective where there are higher proportions of young women—college campuses, for example.[61]

[58] Jacobs 1961, 35
[59] RSG 2000, 12
[60] RSG 2000, 17
[61] RSG 2000, 18

The thirteen other features in the study deal with physical elements such as lighting and cleanliness that the transit authority has immediate responsibility for. An "active neighborhood", on the other hand, is a more external and subjective quality over which the transit authority has little direct control over. It is created by a complex interaction of private decisions, but can be influenced through public policy. Zoning regulations can prescribe densities that generate pedestrian activity.

In seeking to understand the relationship between density and pedestrian activity, urban planners have looked to cities where walking dominates as the preferred mode of transportation. Crawford proposes how modern cities can be retrofitted and entirely new ones built where all local trips are on foot or bicycle, and farther trips are facilitated by a rapid transit system. This can be seen as the ultimate model for pedestrian access to transit. He recommends that the "carfree city should have a floor area ratio (FAR) of 1.5 and mixed uses...produc[ing] a considerable amount of foot traffic most of the time."[62] While noting that this density is less than some of Paris' most desirable neighborhoods, he explains that

> those accustomed to suburban living may find the proposed densities too high, and it is certainly true that not everyone wants to live in a dense urban core. Congestion, density, and overcrowding are not the same things, however. The perceived congestion of modern cities is largely a result of motorized transport. ... Once streets are dedicated to human uses, very high densities are no longer unpleasant and offer rich social opportunities.[63]

Densities at The Crossings, a mixed-use project replacing a defunct enclosed shopping mall in Mountain View, California, are higher than is typically found in other locations of the Silicon Valley—54 du/ha (22 du/acre). A resident admits, "it took me a while to adjust, but I'm liking it more and more. It's not at all confining, since you can walk to everything." Indeed, an "interconnected pattern of tree-lined streets, neighborhood parks and pedestrian paths knits the neighborhood together" and with several nearby office

[62]Crawford 2000, 255
"Floor area ratio" refers to the relationship between the total floor area of a building and the area of the site the building occupies
[63] Crawford 200, 228

buildings, a commuter rail and light rail station. After being placed on the market, the housing units were among the fastest-selling in the region, and only a few years later, resale values were about $100,000 over the original prices.[64]

Less radical than the idea of carfree cities is the concept of transit-oriented development, which recognizes that automobiles have a place in modern cities. Given currency by architect and new urbanist Peter Calthorpe, TOD finds its prototypical application around compromised stations in suburban areas where densities are low. Among many other interventions, Calthorpe recommends an increase in density around transit stations in order to create the nodes of pedestrian activity. He suggests an average residential density of 44 dwelling units/hectare (18 du/acre) within a 600-meter radius (2,000 ft) of stations to support rail transit,[65] and a floor area ratio (FAR) of 0.35 and 0.30 for office and retail space in station areas, respectively.[66] San Jose has created a Transit Corridor Residential land use designation allowing densities of 50 units or more per hectare (20 du/acre or more) within 2,000 ft of rail stations.[67] In the Portland region's LUTRAQ[68] plan developed by Calthorpe's consulting firm, development with comparable densities was concentrated along proposed rail transit corridors in suburban Washington County, west of Portland. The plan configured 75 percent of the growing area's new housing, at 37 du/ha (15 du/ac), in walkable, mixed-use communities within one-half mile of transit stations.[69] A computer model, enhanced with a "pedestrian friendliness" and a "heterogeneity" factor, showed that such patterns would result in a fourfold increase in walking and two-and-a-half times more transit ridership.[70] A reduction in automobile congestion is hoped to attend these increases.

Many critics of transit-oriented development and New Urbanist tenets, however, point out that the increased densities they prescribe will only exacerbate the problems of

[64] Terris 2000
[65] Calthorpe 1993, 58-9
[66] Calthorpe 1993, 78
[67] Santa Clara VTA 2000, 3
[68] Making the *L*and *U*se, *T*ransportation, *A*ir *Q*uality Connection
[69] Concurring with Calthorpe, Fisher and Radisch (1995) indicate that there is "broad acceptance" that 37 du/ha (15 du/ac) is a minimum density for transit-oriented development
[70] Calthorpe 1993, 123-4

congestion. It is, of course, only logical that if patterns of automobility remain basically unchanged while densities increase, congestion will worsen. This, in turn, makes conditions even poorer for pedestrians. Donald Appleyard has shown that automobile traffic is inversely proportional to the social life of public spaces: "the noise, danger, and pollution slowly drive people off the street."[71] Therefore, as station areas are delimited and higher densities are allowed within them, there must also be attendant policies to reduce parking requirements and limit street capacities.

Critics counter that such measures only artificially increase transit ridership and "force" people into travel behavior that they find less desirable. However, the aversion many have to walking and transit is largely due to automobile-related impacts. Furthermore, it must be understood that station areas contain valuable tracts of transit-accessible land where pedestrian travel should predominate. Except in cities with exceptionally dense transit networks such as New York City, these areas and the opportunities they afford comprise only a very small percentage of a metropolitan area's land. Increasing densities and limiting automobiles in these locations demonstrates that a city recognizes that some precincts should favor pedestrians more than cars, and those who prefer to live and work in such areas are thereby offered a choice. Zoning and parking policies have a direct effect on pedestrian activity, and increased transit ridership follows.

Michael Replogle has shown that the creation of "traffic cells" can have a pronounced effect on pedestrian travel. Traffic cells favor access over mobility, limiting the crossing of cell boundaries by trucks and automobiles so that the integrity of the non-motorized and transit network within and between cells is preserved and prioritized. Variations of the traffic cell concept were implemented in Sweden, Japan, and the Netherlands starting in the mid-1970s, increasing transit ridership and the mode share of walk trips in every case. The implementation of traffic cells around Downtown Crossing Station in Boston, Massachusetts, in 1978 led to a 21 percent increase in walking trips, 6 percent increase in transit trips, and a stabilization of traffic congestion in the area.[72] Similar strategies of

[71] Crawford 2000, 72
[72] Replogle 1993

closing some streets to traffic, improving transit service, and parking management efforts can be applied around stations to create more pedestrian-friendly environments.

While still very much a park-and-ride-oriented station, West Falls Church-VT/UVA Station described in previous sections has undergone a pronounced ridership increase in recent years with respect to its neighboring Orange Line stations. This can be attributed in part to the condominiums and university extension center that have been built at its perimeter, increasing the density of development in the station area. Long-term efforts to limit automobiles (e.g., reducing the park-and-ride's capacity) and further increase densities (e.g., building more pedestrian-friendly housing and institutions, especially on land formerly occupied by parking lots) can be expected to increase pedestrian activity and ridership even further.

4.7.2 Pedestrian-Oriented Uses

Along with density, an important component of pedestrian-friendly, transit-oriented station areas is diversity. The term "diversity" is often applied to income levels, ethnicities and other demographic qualities, and is especially emphasized by the New Urbanists as an integral part of their concepts for model communities. Diverse income levels within neighborhoods provide affordable housing and allow people in different life phases to live in the same area. Young adults, for example, can afford to live in the same communities as their more financially established parents. The elderly, in turn, can be near children and grandchildren. People from different walks of life are exposed to each other, so that the needs and concerns of others are more easily understood. This may have a stabilizing effect on urban areas, the opposite of the stark contrast between gated communities of the well-off and the poverty of ghettos found in many U.S. cities.

However, while efforts to increase demographic diversity may result in healthier communities, they will not, by nature, create more pedestrian-friendly neighborhoods. What does have a direct effect on walkability is the diversity of *land uses.* The majority of new development in urban America during the latter half of the twentieth century has been guided by zoning laws that segregate uses into single-use enclaves. Under these codes, residences, workplaces, and retail establishments are placed apart from one another and the large distances between them make walking impractical. As a result, children can no longer walk to school, office workers cannot walk to eateries on their lunch breaks, and evening errands are difficult to complete on foot. Furthermore, modern lifestyles are marked by a trend in which traditional home-work trips are continually falling in their share of overall trips. Greater proportions of trip-making involve shopping, recreational, and entertainment trips that are "chained" together. Trip-chaining prefers that each of the destinations be accessible by the same mode of transportation, and the automobile is often the only one that meets this criterion. When mixed uses surround a transit station, however, a pedestrian can more conveniently complete errands on the way to and from it. The effect is compounded with each station in a mixed-use environment, as more and more origin-and-destination pairs provide a wider range of shopping, recreational, and entertainment venues that the transit rider can access while making a trip that he already must take.

While it would seem that any "progressive" transit authority would be seriously committed to mixed-use zoning and development, transit stations often epitomize the single-use enclave. Station interiors and passageways, as well as plazas and walkways outside of entrances and vast bus loop and parking facilities are often dedicated to the sole purpose of transportation. Mixed-use, however, can begin on transit property with station concessionaires. Some transit systems prohibit food and beverages aboard vehicles and in stations, as does WMATA, but this does not preclude healthy concession activities. Project for Public Spaces suggests such activity in Metro stations:

> The under-utilized spaces on many station mezzanines would be appropriate as locations for non-food related retail (such as well-designed vending carts and kiosks), community bulletin boards [and] musicians... Added retail in stations would increase Metro revenue through leases of space to vendors.[73]

[73] PPS 2000, 36

The PPS report also discusses the opportunity for a station concierge program, offering transit riders the opportunity to have errands taken care of that are not possible along the walk to the station, even the context of a mixed-use station environment:

> This is a service that allows passengers to drop off items to a concierge located at the Metro station in the morning, such as dry-cleaning [and] film...[or] to place orders for flowers or take-out dinner. The concierge then fills the order in collaboration with...businesses in the area. The concierge brings these articles back to the station in the late afternoon, in time for returning passengers to pick them up on the way home. Concierge programs provide additional customers to local businesses that may open too late or close to early for them to take advantage of Metro customers, and eliminates some of the after work chores (and the requisite driving and increased traffic on local roads) to which most working adults attend.[74]

The study notes that a concierge program at a commuter rail station in Maplewood, New Jersey, has been quite successful and enjoys participation from over 75 local businesses. With such a wide range of services available, walking to transit may become attractive for greater numbers of people, as long as they can comfortably carry the items for drop-off and/or pick-up.

Beyond the immediate station headhouse or entrance portals, the transit authority often owns or has jurisdiction over plazas and other open areas that are often devoid of activity. These can be filled with "positive uses," as PPS recommends:

> Station plazas are prime public spaces that could be transformed into great neighborhood public squares, as is regularly done in Europe...programmed with community events or retail activity, to create a real sense of place around Metro stations. ... These public spaces have tremendous potential to... [highlight] local resources and better [connect] Metro stations to local destinations.[75]

Markets have grown up around a handful of Metro stations. Activities such as these require additional management and maintenance that a transit authority may be strapped for resources or otherwise reluctant to provide. However, public-private partnerships can be formed to create mutually beneficial relationships. The Denver (Colorado) Partnership

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[74] PPS 2000, 36
[75] PPS 2000, 48

trains and pays the homeless to maintain that city's most successful pedestrian space, the 16th Street Mall, which was conceived and built as a transit project. New Jersey Transit and a private foundation embarked on a "Station Renewal Program" to "develop and implement a strategy to enhance the connections between stations and neighboring communities by generating broad-based community involvement and inter-agency support." The successful initiative has addressed the complicated inter-jurisdictional issues of integrating stations with adjacent land uses and programming retail activities and events in the intervening spaces.[76]

Finally, mixed uses must be allowed and encouraged beyond the transit authority's property into the surrounding areas within walking distance. Here residences and offices have their place, which, unlike retail or public uses, are generally unsuitable or inappropriate for station buildings and plazas. However, when high densities are desirable, the air rights above stations are appropriate for offices and condominiums, so that it is certainly possible for people to live and work in the building that incorporates the station. San Diego, California, generally considered a low-density, sprawling city, provides an excellent example. The building in Figure 4.53 is built above the 12th and Imperial station of the San Diego Trolley, so that one can reach a day care center, post office, shops and offices without stepping a foot outside the building.

Figure 4.53 12th and Imperial Station
San Diego, California

Mixed uses are incorporated into the station itself, providing opportunities for pedestrian trip-chaining

[76] PPS 2000, 48

This concept is taken a step further by Stewart Schwartz and Ed Risse of the Washington, D.C. area's Coalition for Smarter Growth. An extension of WMATA's Orange Line to Dulles International Airport in Fairfax and Loudoun County, Virginia, is planned to share right-of-way with the Dulles Toll Road. Schwartz and Risse propose that the new stations "be built on platforms over the highway that would also support stores, offices and housing—all of it rising into the sky over the roadway."[77]

Therefore, mixed use does not only mean that different land uses are located near one another horizontally, but that they are also allowed below and above one another in a fine-grained pattern. This is the traditional urban form of streetfront retail and office space with residential space in upper floors. This pattern was ubiquitous in areas of U.S. cities built prior to the mid-twentieth century, when zoning codes disallowing them were almost universally adopted. The repeal of such ordinances is one of the main goals of the New Urbanism. Christopher Alexander, a forerunner of the New Urbanists, charges:

> Use zoning laws, neighborhood planning, tax incentives, and any other means available to scatter workplaces throughout the city. Prohibit large concentrations of work, without family life around them. Prohibit large concentrations of family life, without workplaces around them.[78]

Adding to the advocacy of Alexander, Jacobs and others in support of mixed uses, Calthorpe presents guidelines that he deems especially appropriate for the transit station area. A proportion of 5-15 percent public uses (parks, plazas, open space, public facilities and institutions), 30-70 percent core commercial/employment, and 20-60 percent housing is designed to "encourage pedestrian activity". There can obviously be no formula for creating a mixed-use environment where walk trips predominate, and such standards must be flexible to accommodate wide variety in the urban environment. However, Calthorpe advises that "a certain minimum proportion of uses is required to stimulate pedestrian activity and to provide economic incentives for developing with

[77] Layton 2001, A01
[78] Alexander 1977, 56

mixed-use patterns."[79] The "urban index" used in Portland to measure walkability quantified the density of jobs as one of its two components, because it corresponds with the number of destinations within walking distance.[80] A significant employment density in a station area is a good indication that a station area has a healthy mix of uses to support pedestrian travel.

Mixed uses also help to reduce the dominating effects of automobiles and their impacts on pedestrian-friendliness. Because different uses can have peak parking requirements at different times of the day, parking can be shared. For instance, a parking lot near an office building and a cinema can share the same parking spaces, because evening theatergoers can occupy the parking spaces that office workers have used during the day. In an analysis by Ed Del Duca, the sum of the peak demand for parking in mixed-use development comprising a hotel, cinema, restaurants, retail and offices for each individual use was 20 percent greater than the aggregate peak demand.[81] Bernick and Cervero suggest that shared parking can reduce the scale of suburban activity centers up to 25 percent, "which might translate into a 25 percent more pedestrian-friendly environment."[82] When the potential for shared parking arrangements is recognized, parking requirements can be reduced, allowing higher densities and making walking even more attractive. Budgets for expansive surface parking can be channeled instead to smaller-scaled, more pedestrian-friendly parking structures or to providing amenities for pedestrians.

4.7.3 Pedestrian-Oriented Design

Design follows density and diversity as the final component of urban vitality. Even when higher densities and a mix of uses have been achieved in a station area, the pedestrian environment may still be lacking. Bernick and Cervero credit Pleasant Hill BART Station for advancing "the cause of transit village development more than any other station on the system," bringing 1600 residential units, 140,000 m^2 (1.5 million ft^2) of office space,

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[79] Calthorpe 1993, 63
[80] Calthorpe and Fulton 2001, 70
[81] Del Duca 1995
[82] Bernick and Cervero 1997, 85

and a 249-room hotel to an infill site amongst scattered subdivisions of single-family homes.[83] However, Fisher and Radisch describe the area around the station as a "well-intentioned, but unpleasant urban environment." High densities of residential development are juxtaposed with office buildings, all within walking distance of the station, but the area "feels like it is a mixture of unconnected parts." Residents have to walk through a "series of parking areas and a dismal streetscape" in order to reach the station.[84]

Describing conditions that unfortunately abound in urban areas of the U.S., Crawford observes:

> Beauty and the needs of pedestrians are given little thought, and the long strips of low buildings bordering wide streets fail to create a sense of enclosure. Comfortable places where people gather to enjoy city life scarcely exist. Attractive public squares can hardly be found. Graffiti and litter abound in an environment about which no one cares.[85]

With good reason, Crawford blames such environments on the dominance of the automobile, and thus his prescription for carfree cities. However, simply a lack of automobiles alone does not automatically create a pedestrian-friendly environment. As referred to above, pedestrian-oriented design creates a sense of enclosure. Bringing buildings up close to the street and limiting setbacks accomplishes this. His "pedestrian street" without cars "works best when it is quite narrow" and he suggests that it have an average width of 7 m (23 ft). Calthorpe makes a similar recommendation for 4.5-6 m (15-20 ft) wide sidewalks, along with minimal setbacks, to enliven "commercial areas by encouraging window-shopping and streetside activity."[86] In order to accomplish this, parking is located behind buildings. Additionally, on-street parking is encouraged, as it provides a barrier between moving traffic and pedestrians.

[83] Bernick and Cervero 1997, 189-91
[84] Fisher and Radisch 1995, 22
[85] Crawford 2000, 44
[86] Calthorpe 1993, 79

The design details of buildings can also contribute to a comfortable walking environment. Calthorpe suggests that buildings that "address the street and sidewalk with entries, balconies, porches, [and] architectural features...help create safe, pleasant walking environments." The orientation of buildings, their massing and variation in their detailing can "promote more active commercial centers, support transit, and reinforce public spaces."[87] These qualities work to provide visual interest, a degree of "complexity" that makes distances seem shorter. Monotone streetscapes that a pedestrian can quickly "read" are boring—with little else to focus her attention on, her mind dwells on how much farther she has to walk. Varied and active streets, on the other hand, involve greater complexity, engaging the pedestrian's interest. Thus Calthorpe encourages arcades, porches, bays and balconies in residential areas. In commercial areas, he recommends street-level windows and numerous building entries. Unarticulated blank walls or an unbroken series of garage doors present a monotonous image that makes walking less appealing and thus discourages pedestrian activity.[88] The underlying principle is that design and architecture should be scaled to pedestrians and to walking speeds. Crawford decries the garish automobile-oriented signage of commercial strips and encourages more pedestrian-scaled features such as "small signs without internal illumination."[89]

Scaling buildings, setbacks, and signs down to the pedestrian is augmented by the provision of amenities for them, such as drinking fountains and sidewalk canopies. Street trees provide welcome shade, and additional landscaping adds greenery and beauty that make walking an enjoyable experience. The overall walking environment is improved by a choice of materials and designs that make the street or pedestrian route more like an outdoor living room. Furnished with "street furniture" such as benches, waste receptacles and lampposts designed to complement one another, streets welcome pedestrians and encourage abutters to consider them a part of their own living and working space. Fisher and Radisch note that "this interplay between public and private space adds to the comfort, interest, and attraction of the the transit stop."[90] Benches and shaded or

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[87] Calthorpe 1993, 65
[88] Calthorpe 1993, 80
[89] Crawford 2000, 37
[90] Fisher and Radisch 1995, 23

sheltered areas are especially helpful for children or the elderly, as they are more likely in need of a place to rest along the way. Outfitting trees with grates, cloaking utility boxes with attractive cases, and choosing distinctive patterns for brick or paving materials can help to create a memorable environment that lends a station neighborhood a sense of identity. When the design and architecture of the transit station complements that of the street and pedestrian routes, a strong connection can be made that makes walking to transit seamless and self-evident.

Unfortunately, station entrances are frequent offenders themselves, often set back from streets and separated from them by parking or bus approaches. Calthorpe recognizes that some stations will cater mainly to park-and-ride and bus feeder traffic, but maintains that facilities supporting these modes of access need not "isolate the station from local pedestrians." He points out that "these undesirable facilities can be placed on one side of the station, leaving the other for pedestrian-oriented environments to develop."[91] Fisher and Radisch recommend that parking be designed so as not to "diminish the experience of the pedestrian," providing for "safe, visually interesting, and convenient routes and waiting places." Cedars DART Station is set back from the street, but incorporates a direct link through the kiss-and-ride and bus loop from a nearby intersection to the platform (Figure 4.54). At the intersection, a sculpture greets pedestrians walking to the station, and the distinctive canopies unmistakably mark the station's location ahead (Figure 4.55). Walking away from the station, the pedestrian route is aligned with the axis of the view toward the downtown skyline. Parking is placed on the opposite side of the station so as not to impede pedestrian routes.

[91] Calthorpe 106

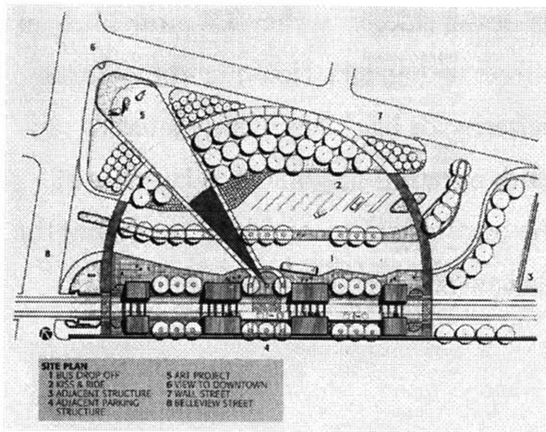


Figure 4.54
Cedars* DART *Station *Dallas, Texas*

The intersection nearest the station (upper left) is connected to the platforms by the paths converging at the station's midpoint (center)

Figure 4.55

The vaulted canopies supporting the catenary are at one end of the pedestrian axis; at the other, the downtown skyline

4.7.4 Guidelines

A vital, active environment around stations will naturally draw pedestrians. Walking to the station will be a matter of course and preferable over other modes. Such walkable environments invariably include increased development densities, mixed uses, and human-scaled design, qualities revisited in the following guidelines:

Does a station area have, or allow for, densities that support healthy pedestrian activity?
Dense nodes of pedestrian activity prompted the invention and construction of the first rail transit systems. Even though they function successfully in many low-density, automobile-oriented contexts today, their effectiveness is much greater when supported by dense development around them. Dense development, in turn, facilitates and encourages pedestrian access by providing a greater number of origins and destinations within walking distance. Urban planners have proposed guidelines for density thresholds, which can be applied to station areas on a case-by-case basis. In general, however, single-level uses and detached single-family homes, warehouses, or "drive-thru" commercial establishments near transit stations generate little pedestrian activity. Zoning should allow

for and encourage, where appropriate, multistory uses and multifamily housing, office buildings and pedestrian-oriented shopping around stations.

Does a station area encompass a diversity of uses?
Mixed land uses around stations support a greater variety of pedestrian trips and encourage trip-chaining using walking and transit as modes. Mixed-use can begin within stations as provisions for concessions and concierge services are made. Station plazas and other property owned by the transit authority can be programmed with markets and community events. Beyond, zoning should allow any pedestrian-oriented use, whether it is of a residential or commercial nature. Overlay districts are a popular and relatively simple method of allowing uses that are otherwise prohibited, such as locating apartments or offices over shops. Parking policies should reflect the diversity of uses and the presence of the transit station, allowing a reduction in minimum requirements when shared parking arrangements are possible.

Does the station area feature pedestrian-oriented design and amenities?
Station entrances should be brought up to the street and not isolated from it by bus bays and parking lots. Buildings in the station area should likewise have minimal setbacks and provide "enclosure" to the outdoor living space experienced by the pedestrian. Park-and-ride lots should be located to the side of the transit station, in a location where they will have the least impact on pedestrian routes; parking for stores, offices, and residences should be placed behind them. Variety and human-scaled detailing along streets add interest and can lower perceived distances. Street furniture and other amenities enhance the quality of the pedestrian environment and increase the attractiveness of walking to transit.

4.8 Conclusion

The preceding six sections have discussed the important factors influencing walking as an access mode to transit stations: the directness of pedestrian routes, the continuity and integrity of pedestrian routes, the ease of crossing streets, the perception of safety and security, the provision of identification and identification, and urban vitality. As has been observed, the factors relate to one another, and efforts to address one often fulfill needs in another. Strategies to improve pedestrian access to stations can recognize these synergies and plan accordingly to realize greater benefits.

Chapter Five
APPLICATION OF GUIDELINES

5.1 Application Methodology

Two very different urban areas provide a context for the application of the guidelines developed in the previous chapter: metropolitan San Juan, Puerto Rico, and Chicago, Illinois.

The San Juan Metropolitan Area has been without rail transit for about half a century. The streetcar lines that fostered the expansion of San Juan inland from Old San Juan disappeared in the 1940s. Rapid post-World War II growth prompted the first discussions concerning the construction of a modern rail rapid transit system in the 1960s, but groundbreaking for the first phase of Tren Urbano did not occur until 1997. The first phase, still a few years from revenue service, includes a segment that is planned to function as the trunk line of an expanded network that will cover a large portion of the metropolitan area (see Figure 5.1). An extension of the first phase would penetrate farther into the Santurce district, and future phases would reach Carolina via Luis Muñoz Marín International Airport and PR-3; extend from Santurce to Old San Juan; and extend south to Caguas. With stations on the future phases defined only conceptually, the opportunites are great for planning now to encourage pedestrian access.

Figure 5.1

Tren Urbano Master Plan

As in San Juan, rail transit played a significant role in Chicago's development. Not only streetcars, but also elevated railroads and later subways radiated out from Downtown Chicago in all directions (see Figure 5.2). Though the city lost its street railways as well, the privately operated elevated lines remained and were consolidated with a city-owned subway line under the auspices of the Chicago Transit Authority in 1947. Since then, expansion of the system outside of the downtown core has taken place in expressway or railroad corridors, placing stations where walking conditions are poor. Encouraged by increased ridership and the revival of many of the neighborhoods that it serves, the CTA is now poised to address the needs of pedestrians at these compromised stations. As efforts are focused on rehabilitating dozens of stations, the long-neglected needs of pedestrians can be incorporated into the plans.

Two future station sites in San Juan and four stations in Chicago were selected as case studies for the application of the guidelines. They were picked because pedestrian access to each of the station areas is particularly inadequate, while representing a variety of contexts. Site visits, aerial photographs, studies, and discussions with persons knowledgeable about the conditions at each station area informed a systematic analysis. Each case study was tested with respect to the six major factors influencing pedestrian access to identify deficiences as well as opportunities for improvement. A long-term "vision" of what a pedestrian-friendly environment around each station might entail was developed, and an implementation strategy devised.

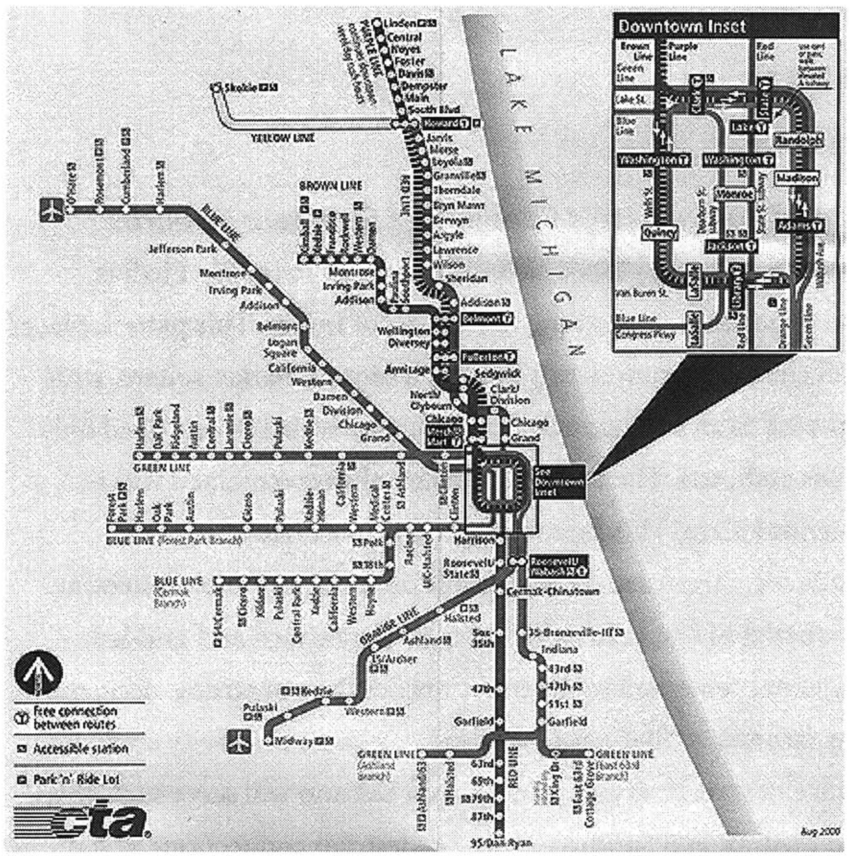


Figure 5.2

The CTA Rapid Transit System

5.2 PRHTA Tren Urbano

5.2.1 Introduction

The success of Tren Urbano depends on convenient and attractive walking routes to and from its stations. In lower-income neighborhoods that will be served by future extensions to Tren Urbano, improved pedestrian access is especially important. In these areas, car ownership levels are low and transit dependency is high. Choice riders can also be attracted to transit as walking conditions near stations are enhanced. Development opportunities around stations, in turn, will be greatly facilitated by pedestrian activity. As neighborhoods of San Juan and adjoining *municipios* become tightly connected to Tren Urbano stations with pedestrian-friendly environments, their residents will enjoy a better quality of life.

5.2.2 Background

Pedestrian Orientation of Puerto Rico's Puebla *and Streetcar Suburbs*

The first European settlements of Puerto Rico, including Old San Juan, Río Piedras, Bayamón and Carolina were patterned according to the Law of Indies. This pattern placed government buildings and churches prominently around a central market square, with development beyond adhering to an orthogonal grid of human-scaled streets plied only by people and their animals and carts. The entire settlement always remained within a comfortable walk of the central plaza. This model adapted as motorized forms of transportation were introduced. Streetcars allowed the development of such "streetcar suburbs" as the Santurce district of San Juan, which was human-scaled and gridded. Concentrations of development remained in the traditional centers or strung along the streetcar routes in a linear fashion, so that residences and commercial activity could be within easy walking distance of transit service. Where Tren Urbano will serve such areas, e.g. Bayamón Centro, Río Piedras, and Santurce, many pedestrian connections to stations will still be in place. However, the ascendancy of automobile travel has meant that even in these areas, pedestrian activity has been compromised. This has especially been the case where *expresos* have been carved through the traditional fabric.

Pedestrian Activity Limited in Post-WWII Development

Dramatic change occurred in postwar years as the streetcar lines were scrapped and investment favored construction of new single-use zones served by automobiles. These were located in the undeveloped areas between the traditional centers and linear, transit-served corridors, which began to decline. Cul-de-sacs and curvilinear streets in subdivisions, often accessible only to residents, replaced the fine-grained grid of neighborhood streets of the *puebla* and streetcar suburbs. A grid of *expresos* and wide, heavily trafficked arterials formed over an emerging metropolitan area encompassing several of the older centers and the newer development in between. These clearly defined corridors are obvious candidates for rapid transit alignments, yet are inherently pedestrian-unfriendly.

Challenges to Pedestrian Access on Planned Extensions

Two major arterials have been identified as corridors for Tren Urbano expansion: Expreso Baldorioty de Castro (PR-26), connecting the Santurce district with Carolina via Luis Muñoz Marin International Airport, and Avenida Regimento 65 de Infantería (PR-3), linking Río Piedras with Carolina and points east. Unfortunately these congested arterials act as barriers to pedestrian activity. Traffic threatens safety and exposes pedestrians to noise and exhaust fumes. Long distances between crossing opportunities mean that pedestrians must walk longer distances between their origins and destinations. Residential neighborhoods are often gated with few access points for pedestrians, compromising the connectivity of the street network. The commercial strips along the arterials are typically poorly connected with their surroundings and cater to motorists, not pedestrians. They may represent a high density of shops and offices overall—but unlike the nodes of the traditional centers and the linear concentrations of the streetcar suburbs, are so dispersed amidst parking lots and access roads that pedestrians can take little advantage from their offerings. Because the willingness to tolerate such miserable walking conditions is low, few people are walking. With pedestrians few in number, perceptions of security diminish, as does justification for sidewalks and other human-scaled amenities. Unless corrective steps are undertaken to accompany the extension of Tren Urbano along these arterials, the new transit stations will attract little walk-up access.

5.2.3 Tren Urbano Case Study Stations

Factors influencing pedestrian behavior and specific interventions that can encourage walking to transit stations have been discussed in previous sections. It is beyond the scope of this work to apply this research to every station along Tren Urbano's future phases. However, a pair of station sites has been selected that represent an area with a traditional urban form predating World War II, and one reflecting postwar suburban development patterns. Thus the pedestrian access issues of other station sites located in either environment are likely to be addressed by these case studies. The table below lists them and their varying characteristics.

name	*anticipated type (line alignment)*	*context (predominant land uses)*
Calle Degeteau Carolina Corridor (PR-3)	subway under major intersection	commercial strip along arterials residential in interior
Calle Providencia Airport Corridor	elevated alongside *expreso*	residential shopping center

Table 5.1 *Future Tren Urbano Station Case Studies*

5.2.3.1 Calle Degeteau

Existing Conditions

Station Context

The future station at Calle Degeteau (PR-181) is planned for a location under the southwest corner of its intersection with Avenida Regimiento 65 de Infantería (PR-3). Both arterials have three traffic lanes in each direction, separated by a median. Right-hand slip lanes with wide radii facilitate movements between the two highways (see Figure 5.3).

Plans call for an *elevado*, or overpass, to carry through traffic on PR-181 over PR-3, and would likely be in place when the station becomes operational.

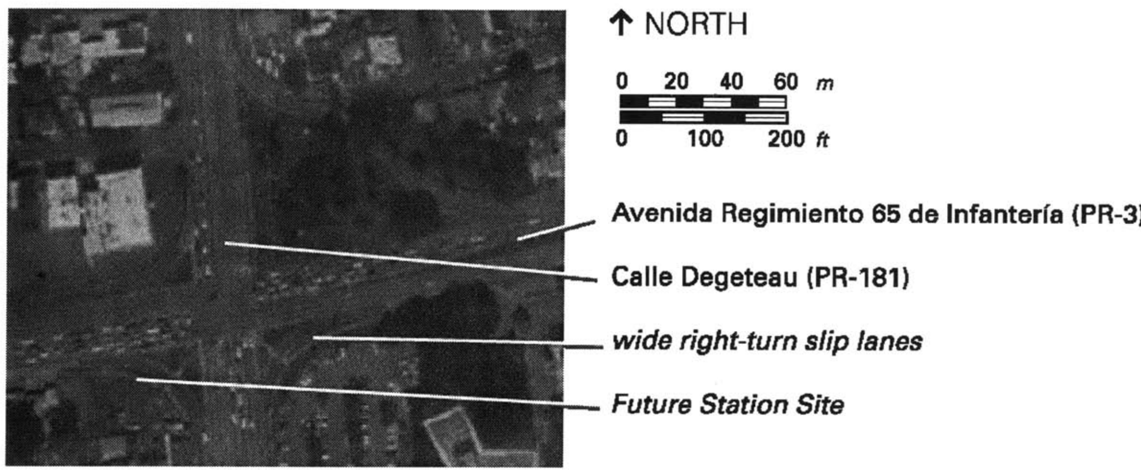


Figure 5.3 *Future Station Site at Calle Degeteau*
(at SW corner of intersection in bottom left corner of photo)

Poor Walking Conditions along Arterials

Both PR-3 and PR-181 are dominated by automobile traffic and auto-oriented design. Sidewalks are the exception, and frontal parking along the commercial strips lining PR-3 is often an extension of the pavement, allowing continuous opportunity for access and egress. Without a space defined for pedestrians, motorists are not expecting them, making for treacherous walking conditions. Where there are defined driveways for access to parking, their geometry and the presence of guardrails present an obstacle course for pedestrians. Absent of the commercial activity characterizing PR-3, PR-181 affords little better in the way of walking conditions. The shoulders of the highway offer no sidewalks, and are studded with signs and utility poles.

Difficult Crossing Conditions

Crossing the wide expanse of the highways—three lanes in each direction—is helped only by the presence of a median (see Figure 5.4). Pedestrian signals and crosswalk markings on the pavement at the intersection are absent. At the extremities of the intersection, the right-hand slip lanes facilitate high speeds and force pedestrians into out-of-direction travel. In the median of PR-181, there is actually a concrete barrier to discourage crossing. This may have been intended to promote safety; however, the lack of legitimate and safe crossing points nearby means that crossing attempts will be made here anyway, subjecting those pedestrians to significant risk.

Figure 5.4
Avenida Regimiento 65 de Infantería (PR-3) at Calle Degeteau (PR-181)

(view: looking west)

Limited Connections to Interior Neighborhoods

Direct pedestrian routes from the future station site to the neighborhoods in the four corners of the intersection are very limited. Streets in the interior neighborhoods do not connect through, blocked by the sweeping right-turn lanes and, on PR-3, the continuous auto-oriented commercial strip. Instead, pedestrians incur a block or two of out-of-direction travel before an opportunity to reach an interior location is available. These are typically not well-defined and may not be perceived as secure or attractive. This is illustrated particularly by conditions in the southwest quadrant of the station area. A ravine separates the Park Gardens *urbanizacíon* from the future station site, doubling walking distances to the intersection for many of the residents.

A Pedestrian-Oriented Future

The intersection of two major arterials, one of which is planned for upgrading to expressway standards, presents a formidable context for a transit station. Nonetheless, a number of interventions could dramatically change the miserable walking conditions that exist today. The high density of residential development around the station site both justifies and necessitates a pedestrian-oriented neighborhood center. The introduction of a Tren Urbano station provides the ideal catalyst.

- An extensive **network of pedestrian routes** to the station will help achieve Tren Urbano's goal of enhancing individual mobility. Lower levels of household incomes combined with more moderate levels of car ownership in the station area suggest that car ownership is a financial burden to many area residents. While providing parking for residents of nearby communities with higher auto ownership (e.g., Trujillo Alto) may be desirable, facilitating walk-up access among residents of the immediate station area should take precedence.
- Current commercial activity (e.g., automobile dealerships) caters to motorists and draws from a market area encompassing an area beyond the neighborhoods near the station. A **pedestrian-oriented center** would provide residents with shops and businesses for daily needs within walking distance that are currently lacking. These stores and services could thrive given the easy pedestrian, transit, and automobile access afforded by the site.

Straightforward Station Design (Initial Action)

A subway station at a multi-level intersection could easily be lost from pedestrian awareness. It should therefore be designed to encourage walk-up access with a straightforward and open design.

- An open station vault would allow natural light and reduce the perceived distance from station entrance to platform.
- An at-grade arcade would be constructed under the PR-181 *elevado* as part of the Tren Urbano contracts. The intention is to place a station entrance on the east side of PR-181.
- A entrance on the north side of PR-3 connecting to the station via an underground passage could be provided by the PRHTA before and during the construction of a PR-3 underpass and a pedestrian-friendly boulevard on the surface.

- A generous and attractive plaza, as well as a tower or other architectural feature acting as a marker, would be designed with the station and included in the Tren Urbano contracts.

Forging Connections (Initial Action)

Introducing crosswalks at intersections and introducing through streets into interior neighborhoods would break down the barriers to pedestrian traffic created by the two highways and the development along them. Traffic calming interventions would further encourage walking and improve the safety of pedestrians and motorists.

- The construction of an *elevado* over PR-3 can be seized as an opportunity for improving the flow of through traffic while calming local traffic. The sweeping right-turn lanes would be removed by the PRHTA and replaced with standard intersection geometry, keeping pedestrian needs in mind.
- The loose grid of interior blocks would be extended to meet the two highways, and connect the Park Gardens *urbanizacíon* directly with the station area.
- Crosswalks and pedestrian signals would be provided at the intersections of PR-47 and PR-181, PR-3 and PR-181, and on PR-181 south of PR-3.
- Sidewalks along the two highways and the new connective streets would provide direct routes of pedestrian access. Their construction along PR-181 could be included in the contracts for constructing the planned *elevado.*

A Mixed-use Pedestrian-Friendly Center (Long-term Efforts)

The part of San Juan east of the Río Piedras district currently lacks a focus for community identity. The Calle Degeteau station site, long an important crossroads between settlements at Río Piedras, Carolina, and Trujillo Alto, continues this tradition as a point of intermodal exchange and becomes a retail and business center.

- An underpass for through traffic on PR-3 would allow the creation of a more pedestrian-friendly boulevard, effectively expanding the station plaza to the northwest corner of the intersection. The PRHTA could undertake the construction of the underpass structure in conjuction with the Tren Urbano alignment.

- Auto-related uses (gas stations, car washes, repair shops, and dealerships) would be zoned out of the station area by the Puerto Rico Planning Board (or the Municipality of San Juan, once it has obtained planning autonomy).
- New privately-developed streetfront shops and offices would line the boulevard on Avenida Regimiento 65 de Infantería, replacing the right-turn slip lanes and the empty intervening spaces created by them. Housing in upper floors accessed by secured, semi-public common spaces would provide desired levels of security and exclusivity while placing "eyes on the street".
- Parking would be limited to locations behind streetfront buildings, with convenient though limited driveway access.

Specific interventions are summarized in Table 5.2 on the following page:

Table 5.2

Calle Degeteau

Tren Urbano
Carolina Corridor (PR-3)

A subway station at the intersection of Avenida Regimento 65 de Infanteria (PR-3) with Calle Degeteau (PR-181) is planned along a future phase of Tren Urbano connecting Carolina Centro with the initial trunk line at Río Piedras. Both arterials carry heavy traffic, and a planned elevado on PR-181 would impose an additional barrier on pedestrians. The four quadrants formed by the intersection have moderate to high densities, with low to moderate incomes and car ownership levels.

qualities	**initial action**		**long-term efforts**
	by PRHTA within TU Contract Limits	by others beyond TU Contract Limits	by public and private entities
Directness of Pedestrian Routes	• design direct walkways through bus and público staging areas • design station entrances on both sides of PR-181, on N side of PR-3 (pre-underpass)	• connect streets from residential areas beyond arterials through commercial strip • introduce crosswalks on PR-181 S of PR-3, create refuge islands on wide median	• pursue underpass for PR-3 through traffic to allow for a pedestrian-friendly boulevard on surface (or broad pedestrian underpass with shops leading directly to station mezzanine)
Continuity and Integrity of Pedestrian Routes	• locate park-and-ride so as not to interrupt continuous pedestrian—parking structure recommended	• consolidate curb cuts along both arterials (especially PR-3), build new sidewalks • eliminate frontal parking to accommodate pedestrian desire lines	• encourage new streetfront retail to orient to walk-up access by nearby residents, limiting parking to backlot locations
Ease of Crossing Streets	• design station entrances on both sides of PR-181, on N side of PR-3 (pre-underpass) • install crosswalks and pedestrian-serving signals at PR-181/PR-47 intersection	• install crosswalks and pedestrian-serving signals at PR-181/PR-47 intersection • introduce path to Park Gardens urbanization	• pursue underpass for PR-3 through traffic to allow for a pedestrian-friendly boulevard on surface (see also Directness above)
Perception of Safety and Security	• design station open to the surface, facilitating unobstructed sight lines • incorporate an arcade under PR-181 into the station proper	• program area SW of station site now vacant as greenbelt with activity	• encourage additional housing units, especially above retail, to put eyes on street • encourage relaxation of gated access, discourage new gating
Community Involvement and Engagement	• begin public meetings concerning extension construction early; model after Río Piedras experience	• incentivize efforts by local business district and neighborhood/homeowners' associations to embrace TU and tackle issues beyond PRHTA's control	• cultivate station as a community center and focal point for the surrounding neighborhoods through tower marking station, plazas
Urban Vitality	• program concessionaires into station passageways and arcade under PR-181 • initiate joint development to create new town center (public services/facilities, retail)	• zone station area for more ped-oriented uses to replace those now devoted to auto sales and maintenance	• relocate auto-related uses (gas stations, car washes, repair shops, dealerships) outside of station area

5.2.3.2 Calle Providencia

Existing Conditions

Station Context

An elevated station at Calle Providencia is planned for a location between Expreso Baldorioty de Castro (PR-26) and its southern marginal road on the eastern edge of San Juan's Santurce district (see Figure 5.5). Calle Providencia is a neighborhood street serving a cross-section of neighborhoods: to the south of the *expreso*, a dense, lower income neighborhood of low-rise dwellings; directly north, a low-income housing project; and farther north, a less dense, wealthier precinct near the ocean. Nearby lies a large park, Parque Barbosa, and the suburban-style Norte Shopping Center.

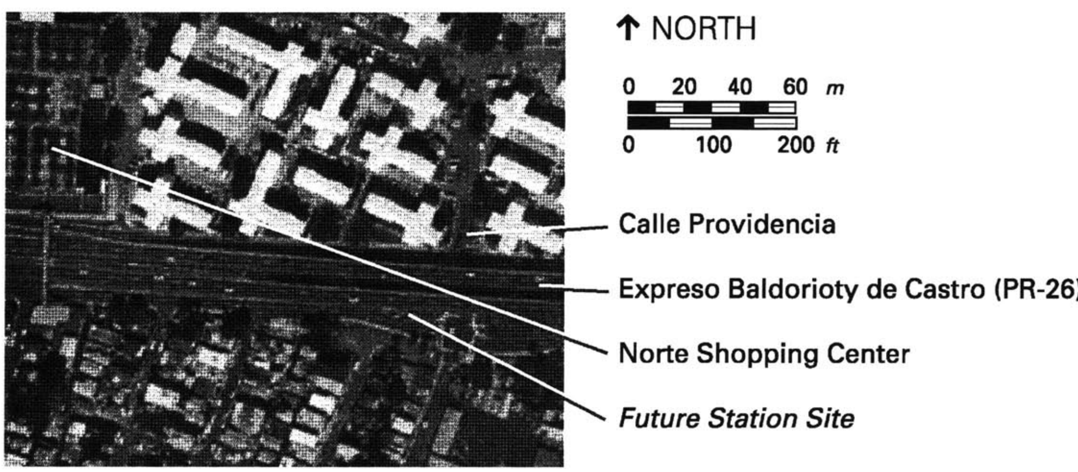


Figure 5.5 Future Station Site at Calle Providencia

General Lack of Pedestrian Facilities

While the grid of streets in the Villa Palmeres neighborhood south of the future station site provides good connectivity and multiple choices for pedestrians, sidewalks are often missing, in disrepair, or frequently parked on by automobiles. Additionally, some streets do not connect through to the marginal road of the expressway. This either requires a convoluted path in order to reach the future station site, or an uneasy walk through a vacant lot. The marginal road acts as the on- and off-ramp for the expressway, so its traffic is traveling at higher speeds than the neighborhood streets. While this threatens safety, a perception of security is compromised by the fact that few buildings are facing the marginal road.

The Expreso*'s Dividing Effect*

PR-26 is a limited-access, divided highway, and its at-grade portions are fenced off. Opportunities for crossing from one side to the other are infrequent, imposing significant out-of-direction travel for pedestrians. One type of crossing is provided by pedestrian bridges, such as the one visible at the far left in Figure 5.5. These are usually designed inconveniently with ramps switching back and forth, and unattractively with chain link enclosures. In addition, they are typically not handicapped-accessible. A second type of crossing is afforded when streets like Calle Providencia pass under the expressway's *elevados.* They are often unattractive to pedestrians as well: adjacent intersections with the marginal roads are designed for wide turning movements, requiring longer crossing distances, and the spaces under the *elevados* are dimly lit and irregularly maintained.

The Insular Design of Residencia Llorens Torres

A large public housing project, Residencia Luis Llorens Torres, lies north of the station site. It represents a high concentration of transit-dependent people who will benefit greatly from Tren Urbano. Unfortunately fences surround the housing project, with only a few entry points for pedestrians. The fences block those who might have a more direct path if they were able to walk through, and inconveniences the residents themselves with out-of-direction travel. Additionally, the housing units are oriented in an insular pattern that works against pedestrian activity. Individual apartment buildings are aligned in an orthogonal pattern at an angle with surrounding development. This turns them away from the nearby shopping center or park, which could be objects of focus. Although sidewalks do provide internal circulation, parking lots and driveways interrupt them. The siting of the buildings block clear lines of sight through to points beyond, and this coupled with the monotony of the architecture leads to easy disorientation. The jarringly different appearance of the apartments compared to their surroundings stigmatizes its residents and instills fear in the minds of non-residents. Whether or not their apprehension is justified, the more affluent residents of the oceanfront Santa Teresita and Park Boulevard neighborhoods to the north are not very likely to walk to the future station site given current circumstances.

A Pedestrian-Oriented Future

Because the future Tren Urbano station at Calle Providencia is surrounded by dense, low-income neighborhoods, a high level of pedestrian access can be expected. Here is a case where a compromised station alignment (one along Expreso Baldorioty instead of under Calle Loíza) actually has the potential to better serve the community—a station at the *expreso* is nearer to a greater number of potential riders. However, the benefit of close proximity will be negated unless a more pedestrian-serving environment, like that found along Calle Loíza, is created around the station site.

- More than half of the households in the neighborhoods immediately surrounding the station are without a car. However, as incomes and demand for mobility rise, captive Tren Urbano riders will be lost unless their walk to the station is perceived as pleasant and convenient.
- Norte Shopping Center employs 300 and other commercial activity on Calle Loíza and on Expreso Baldorioty's marginal roads employs many more. Tren Urbano can be the mode of access of choice for these employees if convenient and attractive connections to the station are made.
- Separated by an expressway, discordant design, or a single-use focus, the four main origins and destinations in the station area (the interior Villa Palmeras neighborhood, Norte Shopping Center, Residencia Luis Llorens Torres, and the oceanfront Santa Teresita and Park Boulevard neighborhoods) relate poorly to one another. The future Tren Urbano station can function as a positive community gathering point and center of activities, encouraging better integration of this eastern section of the Santurce district.

Enhanced Station Design (Initial Action)

Parallel with efforts to have the neighborhoods "reach in" toward the station with pedestrian routes and sidewalks, the station must also "reach out" to attract pedestrian access.

- The space under the *expreso* would host concessionaires and an attractive, well-lit arcade that is perceived as part of the station. This would be built as part of the station within the Tren Urbano contracts.
- The sidewalk plaza programmed for Calle Providencia under the *expreso*[1] would continue on the far sides of the intersections with both marginal roads (see Figure 5.6). At these locations, a station marker and other amenities (e.g. information boards, benches) would signal the de facto station entrance.
- A west station entrance would be incorporated with an improved pedestrian bridge over Expreso Baldorioty. The point of entry to the station then moves out to a pedestrian plaza at Norte Shopping Center, to be developed by the shopping center owners.

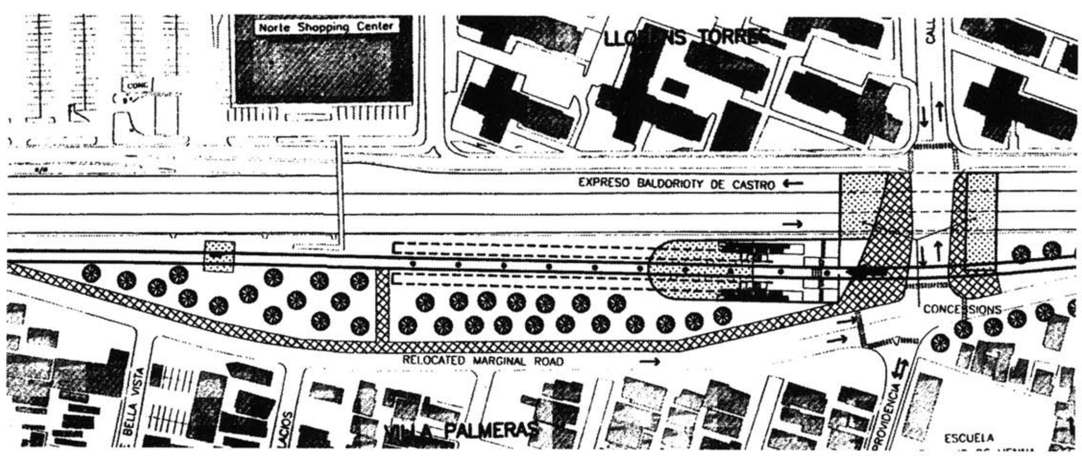


Figure 5.6 Future Calle Providencia Station with Sidewalk Plazas (crosshatched)

Establishing a Pedestrian Route Network (Initial Action)

Preliminary schematics call for "sidewalk plazas" at the station entrance (see Figure 5.6); this alone, however, will not suffice. Upgrading current crosswalks and sidewalks, and introducing them where they are currently lacking, will help connect the widely differing land uses and neighborhoods around the station.

- Pedestrian routes along desire lines through the Llorens Torres housing—especially between the shopping center and Calle Providencia and Calle Loíza and the station site—would be established, cutting through the existing labyrinth created by the apartment buildings and leading toward the station. The housing authority would introduce additional pedestrian gates along the perimeter fencing to facilitate this.
- Streets south of the *expreso* that do not connect through to the marginal road would be extended. Alternatively, pedestrian plazas closed to through traffic would make a connection. The Municipality of San Juan would carry out these activities.
- Curb cuts into the parking lots of Residencia Llorens Torres would be consolidated; parking along the west side of Calle Providencia would be relocated and replaced with a direct and generously dimensioned sidewalk by the housing authority.
- Street trees, bollards, or other treatments, in conjunction with well-defined on-street parking or off-street parking opportunities, would preserve the integrity of sidewalks from on-the-curb parking along the major pedestrian routes. This could be a municipal project assisted with funds from Tren Urbano.

Modifications to Residencia Llorens Torres (Long-term Efforts)

The central location of the Llorens Torres housing surrounded by the future station site, Norte Shopping Center, and other neighborhoods north of Calle Loíza places it in a position to be the crossroads of the station area. Modifications will have to be made to the current design of Llorens Torres in order to achieve this. Calle Providencia would be emphasized as the main pedestrian route from Calle Loíza to the station, but secondary paths through the housing project "superblocks" would be created.

[1] The sidewalk plaza is included in the preliminary design for the station as developed by the Tren Urbano GMAEC (Tren Urbano GMAEC 1998)

- The housing and parking would be changed by the housing authority so that current conditions—monolithic buildings surrounded by parking lots—appear more like individual rowhouses lining well-defined public streets. Efforts could be as simple as making modifications to façades and reconfiguring parking, or as involved as tearing down buildings and rebuilding them along new streets that relate better to the surrounding neighborhoods.
- Calle Providencia north of the *expreso* would be fronted with smaller-scaled residential units, live/work units, or shops privately developed with oversight of the housing authority. This would soften the harsh contrast created by the existing public housing buildings and populate major pedestrian routes to the station with activity.
- Norte Shopping Center would be similarly reconfigured by its owners, addressing the Residencia Llorens Torrens and the station with smaller units occupying the blank walls of larger supermarkets or discounters. The expansive parking lot would be broken up with outparcel uses. A public plaza at its southeastern corner would help establish the connection to the station and could host markets or community events.

Specific interventions are summarized in Table 5.3 on the following page:

Table 5.3

Calle Providencia

Tren Urbano
Airport Corridor

An elevated station at the intersection of Expreso Baldorioty de Castro (PR-26) with Calle Providencia is planned along a future phase of Tren Urbano connecting Luis Muñoz Marin International Airport with the initial trunk line. The proposed station is located convenient to the lower-income neighborhoods in the northeastern part of Santurce, but a third of a mile south of the area's main commercial street, Calle Loíza. This separation, the location of a large public housing project, may discourage access, especially from wealthier oceanfront areas.

qualities	initial action		long-term efforts
	by PRHTA within TU Contract Limits	by others beyond TU Contract Limits	by public and private entities
Directness of Pedestrian Routes	• design additional west station entrance • design connection from station to existing ped overpass S of Norte shopping center	• introduce clearer paths through angled grid of Residencia Luis Llorens Torres • connect streets from residential areas through to PR-26 (e.g. Calle Merhoff)	• explore reconfiguration of Res. Llorens Torres so that direct paths and axes toward station, shopping center can be established
Continuity and Integrity of Pedestrian Routes	• build sidewalks along PR-26 marginal road W and E of Providencia; fill in with shops for community enterprises	• consolidate driveway entrances to Llorens Torre interior parking, straighten sidewalks	• build additional sidewalks and pedestrian connections on S side of PR-26 marginal road W and E of station into dense, low-rise neighborhood
Ease of Crossing Streets	• design connection from station to existing ped overpass S of Norte shopping center • install crosswalks and ped-favoring signals at Prov./PR-26 marginal road intersections	• install crosswalks and pedestrian-favoring signals at Providencia/Loíza intersection	• increase pedestrian space on the crossing of Providencia on the S side of PR-26 marginal road
Perception of Safety and Security	• incorporate an arcade and concessions under the elevado along Providencia	• program PR-26 marginal road S of station with retail and community facilities	• encourage new smaller-scaled residences, some streetfront shops/offices on Providencia between Loíza and PR-26
Community Involvement and Engagement	• begin public meetings concerning extension construction early, model after Rio Piedras experience	• incentivize efforts by local business district and neighborhood/homeowners' associations to embrace TU and tackle issues beyond PRHTA's control	• cultivate station as a community center and focal point for the surrounding neighborhoods to bridge the expressway gap
Urban Vitality	• program concessions into space under elevado along Providencia	• zone station area for more ped-oriented, mixed uses (retail w/in Res. Llorens Torres, offices/residential at Norte Shopping Ctr) oriented along streetfronts	• reconfigure Norte Shopping Center as mixed-use center oriented toward Res. Llorens Torres and station along streetfronts

5.2.4 General Applications for Tren Urbano

Possibilities for improving pedestrian access to future stations are illustrated by the following examples. They represent successful means of resolving common impediments found at the two case study sites, and shared by other locations identified for future Tren Urbano stations. They may be readily applicable to the case study sites, and as success is demonstrated with the stations planned and built there, experience will be gained for application to other stations throughout the system. The first application

- Improving the Walk under Elevated Highways

is an initial action that can be incorporated into plans for individual stations. The others

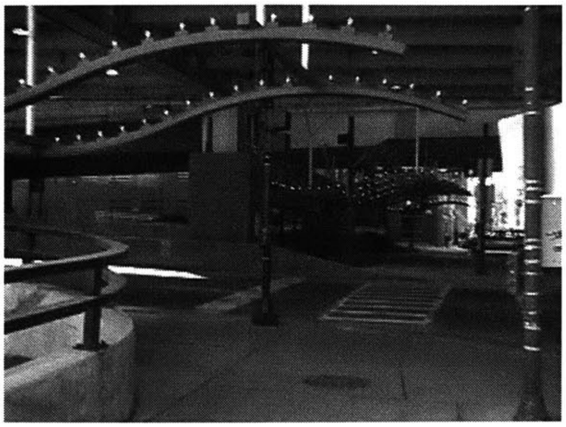
- Instilling Station 'Ownership' through Community Involvement and
- Rethinking Affordable Housing

involve long-term efforts.

5.2.4.1 Improving the Walk under Elevated Highways

The City of Chicago employs an attractive means of connecting the recreational opportunities of its lakefront with downtown, which are separated from each other by Lake Shore Drive, an elevated highway.

- Grand Avenue connects Navy Pier, a popular entertainment and recreational venue, with Chicago's most important shopping boulevard, Michigan Avenue, and with a rapid transit station. Where it crosses under Lake Shore Drive, a canopy of lights scales the voluminous space down to pedestrians and defines their path from one side to the other (see Figure 5.7).
- A branch of the city's lakefront trail extends along the Chicago River to penetrate downtown as a riverfront promenade. Where it crosses under Lake Shore Drive, a canopy of lights similar to those on Grand Avenue, as well as artwork along the walls, make an otherwise forbidding environment inviting (see Figure 5.8). As a result, the riverfront trail is easily understood as an extention of the lakefront trail.



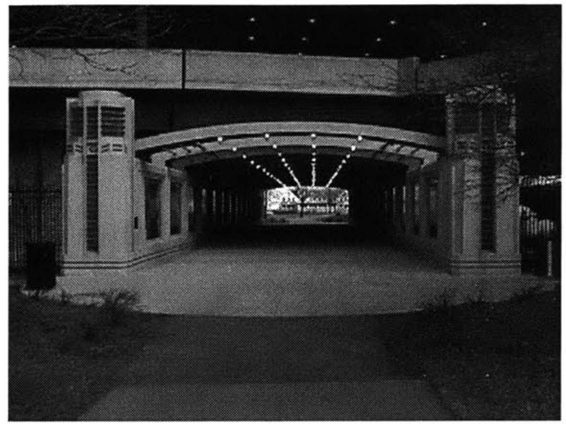


Figure 5.7 *Figure 5.8*
Lighting and artwork under Chicago's Lake Shore Drive
at Grand Avenue *at the Chicago River*

Application to Tren Urbano (Initial Action)

Expressways cut through many neighborhoods in Metropolitan San Juan, and grade separations are often established by means of *elevados.* Along two expressways designated as corridors for future phases of Tren Urbano, Expreso Baldorioty de Castro (PR-26) and Avenida Regimiento 65 de Infantería (PR-3), this occurs at Calle Providencia and is planned at Calle Degeteau (PR-181), both slated as sites for future stations.

Pedestrian routes to both future stations would benefit from treatments that can learn from those implemented in Chicago. At Calle Providencia, preliminary plans suggest that the space under Expreso Baldorioty feature a generous "sidewalk plaza" and concession space. A lighted canopy overhead and artwork in the pavement or walls would help create an identity for the community that is currently lacking, as well as improving the walk to the station for residents of the neighborhoods north of Expreso Baldorioty.

Similarly, an attractive arcade under the planned *elevado* over PR-3 at the Calle Degeteau station site would improve the walk to the station for those living east of the intersection. The *elevado* has yet to be constructed, allowing the arcade to be incorporated into its design. Even if a pedestrian bridge over Calle Degeteau is incorporated into the station[2], there will still be a desire to cross at-grade, especially on the north side of the intersection. Arcades under the *elevado* on both the north and south sides of PR-3 would define pedestrian space and assuage the dominating presence of the overpass.

5.2.4.2 Instilling Station "Ownership" through Community Involvement

Fruitvale BART Station in Oakland, California, is one of the nation's most promising examples of an emerging "transit village", and is unique because of its inner-city location. Rapid growth of Bay Area suburbs and new shopping malls in the 1950s and '60s drained this area of eastern Oakland of residents and vitality. A number of redevelopment studies and proposals had been developed by the late '80s, but none had achieved a critical mass of support and investment.

The tide began to turn in 1991 when the area's grass roots Spanish Speaking Unity Council (today, simply Unity Council) proposed a "big idea"—a full-fledged rebuilding of the community focusing on Fruitvale BART Station, rather than on a few individual projects. This was prompted by the community's disapproval of a parking structure proposed by BART, which threatened to hasten further decline. The idea took form at a 1993 design symposium well attended by local residents. A pedestrian plaza would connect the station, isolated by parking lots and a backlot streetscape, with 14th Street, the community's traditional commercial artery. Shops and community facilities would line the plaza and residences on upper floors would populate the village throughout the day (see Figure 5.9).

The first public improvements took shape in the late '90s, with housing for seniors opening in 1998. The first phase is due for completion in 2001, and much private investment beyond the village has been attracted. The Fruitvale Transit Village has enjoyed success largely due to strong participation among local residents in a decade-long planning process.

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[2] This has been proposed by Miranda-Palacios (2000)

- The initial design charette in 1993 sought community input, unlike the mandatory "public meeting" held by BART as part of the process of attempting to construct the now-cancelled parking garage project. The vision of a "big idea" induced community enthusiasm and brought the area into the political spotlight. The Unity Council fostered this momentum with follow-up meetings soliciting feedback from the community.
- The Unity Council aggressively pursued public and private funds. Substantial grants from the Federal Transit Administration, as well as prominent private foundations, demonstrated to community members that the efforts of the Council, BART, and the City of Oakland were serious and would actually bring about the envisioned revitalization. These funds, earmarked for initial public improvements such as the pedestrian plaza, a new bus transfer facility, and a police substation, in turn leveraged private investment.

The transit village plan inspired the community because it addressed their needs and engaged them beyond simply being passive observers.

- The years of decline had been attended by little increase in housing stock, whilehousehold sizes had been rising. The plans envisioned significant new residential development, including some above retail space that could allow under- and unemployed residents to start their own businesses.
- An estimate of over 700 new jobs will be created by the project, and the Unity Council is committed to making sure that as many of them as possible are filled by local residents.
- The transit village would bring shopping opportunities and community facilities, such as a library, to residents who otherwise have to go to other parts of the city.
- A parking garage was deliberately sited at 14th Street instead of at the station, so as to ensure pedestrian traffic. This would introduce BART riders coming from farther afield, who may have been wary of the neighborhood in the past, to its retail offerings and unique multi-cultural atmosphere.

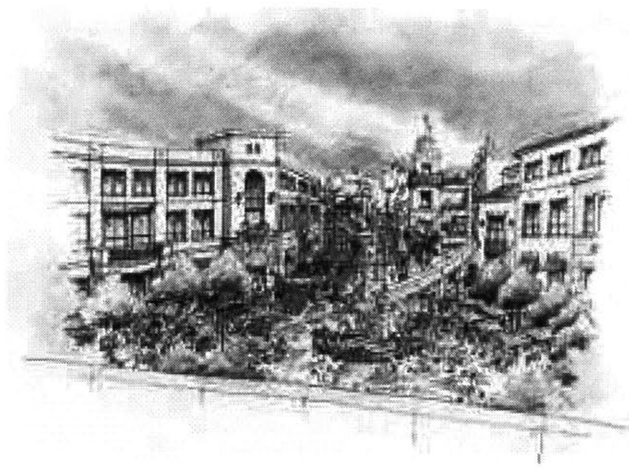

Figure 5.9 ***Fruitvale BART Station***
Oakland, California

An artist's conception of the centerpiece of the Fruitvale Transit Village, a pedestrian plaza replacing parking and vacant lots

Application to Tren Urbano (Long-term Efforts)

The concept of rail transit is foreign for many Puerto Ricans. Even after the initial phase of Tren Urbano is operational, it may still be an unfamiliar, and thus undesirable, element in neighborhoods to be served by subsequent phases. Community involvement efforts can begin now to ensure that Tren Urbano fulfills its intended role and maximizes opportunities for neighborhood revitalization.

- The ownership and even pride in a neighborhood station, engendered through a process similar to that experienced at Fruitvale, will ensure that it is heavily used by the surrounding community. The vested interest in the station and a sense of its indispensibility in the minds of nearby residents identifies it to them in a way that no architectural feature or signage program ever could.
- The decline of the Fruitvale neighborhood of Oakland and the economic status of its residents is mirrored by San Juan's Santurce district. A "vision" like that developed by the Unity Council, using Tren Urbano as a catalyst, could improve the lives of those living near the future Calle Providencia station by offering them more opportunities. Living up to its name, the Unity Council has sought to bring people of different ages, incomes, and ethnic backgrounds into daily contact through the transit village plan. Similar plans at Calle Providencia could help bridge the differences between the disparate neighborhoods around it.

- While the station at Calle Degeteau will serve a higher-income area than the one at Calle Providencia, it still shares characteristics in common with Fruitvale: a haphazard, auto-dominated environment disconnected from surrounding neighborhoods. Just as Fruitvale Station attracts motorists from other parts of Oakland and the East Bay, Calle Degeteau Station will also be an important intermodal transfer center intercepting park-and-ride access from points beyond the station area, e.g. Trujillo Alto. Plans for the new station could also place its parking in a location that will result in high levels of pedestrian activity at the station plaza and encourage commuters to patronize local businesses, as those for Fruitvale's transit village do.

5.2.4.3 Rethinking Affordable Housing

Changes along Chicago's Lake Street Elevated—now known as the Green Line—show how new paradigms and programs are helping lower-income populations to better housing.

The population of the West Garfield Park neighborhood, located near the Green Line Pulaski Station, shrunk from 60,000 in 1950 to 24,000 in 1990. In the early '90s 40 percent of the land around the station was empty, and the surrounding area was riddled with vacant lots. Given that fewer than half of the households had a car available, while only six percent of neighborhood residents rode the "el" to work, the Chicago Transit Authority (CTA) threatened to discontinue service in 1992. Residents hoping to avert the loss of rapid transit were assisted by the Center for Neighborhood Technology (CNT), which proposed using transit-oriented development as a means of maintaining the elevated line's viability and turn the neighborhood's fortunes around.

While the transit-oriented development proposals promised to bring community services and shopping opportunities previously lacking, it also succeeded in saving the elevated line, which was rehabilitated between 1994 and 1996. CNT and CTA recognized that there was great potential in increasing the transit ridership among those residing near the line.

It was reasoned that if they could reduce their spending on automobiles by riding transit, they could afford better housing. This idea eventually developed into the West Garfield Park Location Efficient Mortgage (LEM), a special loan program that increases the borrowing power of local residents. One estimate places the leveraging power of living in a transit-oriented neighborhood at $54,000, quite a significant sum compared to the cost of the new townhomes that have been rising on West Garfield Park's vacant lots. Integral to the LEM concept is a deeply discounted transit pass for new homebuyers.

Two miles further toward the Loop along the Green Line lies the Near West Side, a largely non-residential area that nonetheless boasts 20 percent of Chicago's public housing stock. One of the projects built in the 1960s, Governor Henry Horner Homes, featured monolithic, 13-story apartment buildings within superblocks of unprogrammed, indefensible space. Due to these notorious conditions and persistent social instability, the project's population declined in the '70s and '80s. In the mid-'90s the federal Department of Housing and Urban Development instituted the Hope VI program, replacing some of the nation's large-scale, modernist "projects" of the '50s and '60s, including Henry Horner Homes, with more sustainable forms of low-income housing. The idea was for

> public housing to become like *Where's Waldo?*—invisible in the urban fabric, indistinguishable from all other types of private and publicly-assisted homes and apartments.[3]

Thus, Henry Horner Homes has been redesigned as townhouses, duplexes, and small apartment buildings that look not unlike those financed privately. Never more than a few stories high, they are more human-scaled, as are the blocks, which occur at regular intervals and match Chicago's historic grid. Community uses, stores, and businesses are integrated to provide mixed uses and meet the daily needs of residents. Intended to relate better with private housing, the Hope VI makeover has already spurred the construction of new townhomes nearby which are selling in the $100-180,000 range.

Application to Tren Urbano (Long-term Efforts)

Tren Urbano will serve many neighborhoods with significant levels of affordable housing. The advent of rapid transit can mean a relief to household budgets strained by auto ownership. Trips now undertaken by automobile can be replaced with linked pedestrian and transit trips. Location efficient mortgages, as pioneered in Chicago's West Garfield Park neighborhood, would indirectly boost pedestrian access to transit.

Residencia Luis Llorens Torres has many of the same dysfunctional characteristics that Henry Horner Homes did before the Hope VI initiative. Its current configuration blocks pedestrian access to the future station site at Calle Providencia by imposing convoluted paths and its intimidating appearance. Demolition of the existing buildings, as was done in Chicago and other Hope VI cities, may not be appropriate for the Llorens Torres project. Nonetheless, less invasive efforts that connect it to its surroundings and diminish its austerity will help improve access to the station site for its residents, facilitate "through traffic" by pedestrians from surrounding neighborhoods, and more completely integrate an area divided by an expressway and disparate demographics.

5.3 CTA Rapid Transit

5.3.1 Introduction

Better pedestrian access to Chicago's rapid transit stations is needed. Additional riders will be attracted to CTA if walking is more convenient and pleasant. Combined pedestrian and transit trips can replace automobile trips, displacing the pollution and congestion they cause. Improved pedestrian access addresses equity concerns, as other modes are not available to all, particularly captive riders. Choice riders, who form the majority of CTA's

[3] Weiss 2000

ridership, will in turn find transit more appealing through such enhancements.[4] Better walking conditions around stations also contribute greatly to transit's ability to attract development. A better quality of life for Chicagoans will result as neighborhoods are better connected with CTA's rapid transit system.

5.3.2 Background

Pedestrian Orientation of Original Network

The extensive CTA rapid transit network began as privately owned elevated railroads radiated out from downtown Chicago, starting in the 1880s. In this era prior to the use of the automobile and the advent of buses, walking was essentially the only means of access to the elevated lines. Thus development closely followed the lines so that homes and businesses could be within easy walking distance of stations. The gridiron pattern of Chicago's streets suited pedestrians well by providing multiple routes between origins and destinations and facilitating easy orientation. Many older stations still enjoy such favorable connections to their surroundings; however, the domination of the automobile has had an almost universal and negative impact on walking to transit.

Pedestrian Access Compromised on Newest Lines

In the face of growing competition with the private automobile and significant changes in population and employment patterns, many stations and line segments were closed in the latter half of the twentieth century. This period, however, was marked by a number of expansions, all of which took advantage of the right-of-way of other transportation corridors. The first-ever expressway median transit line opened in the Congress (now Eisenhower) Expressway in 1958. This "innovation" was followed by a similar line in the Dan Ryan Expressway in 1969 and in the Kennedy Expressway in 1970, which was extended in 1983 and 1984 to serve O'Hare International Airport. Most recently, the Orange Line opened in 1993 and shares its alignment with freight railroads to serve

[4] A recent survey found that 60 percent of CTA riders either own a car or choose not to own a car because of a preference for transit (Northwest Research Group 1999, 4)

Midway Airport.[5] Blocked from their surroundings by expressways or railroads, pedestrian access was inherently compromised to nearly all the new stations.

Challenges to Pedestrian Access on Newest Lines

Expressways and rail corridors increase distances that pedestrians must walk to reach transit stations. Development has not clustered around the new stations as it had around the elevated stations in the past, but instead has taken on a more dispersed, auto-oriented pattern. Traffic on nearby streets travels at high speeds to access and egress expressway ramps. This not only threatens pedestrian safety, but also makes walking unpleasant due to the noise and splash of passing automobiles. Individuals are unwilling to endure such conditions if they can avoid them, and an auto-orientation in surrounding uses (e.g., gas stations and "drive thru" retail establishments) means even fewer people are walking. Thus, perceptions of safety and security as well as urban vitality decline, and basic maintenance (e.g., repair of sidewalks) as well as amenities (e.g., pedestrian-oriented signage) are forgotten. Pedestrian access spirals downward, and former riders who choose more attractive alternatives are lost from the transit system.

5.3.3 CTA Rapid Transit Case Study Stations

This research has identified factors that influence pedestrian behavior and specific interventions that can encourage walking to transit stations. It is beyond the scope of this work to apply this research to every CTA rapid transit station. Instead, a few stations have been selected that represent a range of different station area environments while together addressing the issues that are of general concern for the entire system. The findings for these case studies can then have broad application to many other stations in the system. The table below lists the case study stations and their varying characteristics.

[5] Rail Operations Division 2000, 9-10

name	*type* *(line alignment)*	*context* *(predominant land uses)*
87th Red Line–Dan Ryan Branch	depressed expressway median	commercial and residential (separated)
Medical Center Blue Line–Forest Park Branch	depressed expressway median	institutional
North/Clybourn Red Line–Howard Branch	subway	commercial, residential and industrial (mixed)
Irving Park Blue Line–O'Hare Branch	elevated expressway median	residential, local commercial (mixed)

Table 5.4 CTA Rapid Transit Station Case Studies

5.3.3.1 87th

Existing Conditions

Station Context

87th is located in the median of Dan Ryan Expressway, and is subjected to the noise and barrier created by this principle gateway for traffic entering Chicago from the south. The station is the last intermediate station before the Red Line's terminus at 95th, and serves the Chatham area. The station headhouse is located on the south side of West 87th Street.

Poor Walking Conditions on Expressway Overpass

Dan Ryan Expressway cuts a generous trench through the city's southern neighborhoods, with sloping abutments that require very long bridges for crossing streets. Thus, pedestrians walking to the headhouse at the bridge's midpoint are very exposed to the elements in an environment of cars, concrete and chain link.

Destinations to the West Poorly Connected

To the west, an industrial area and, closer in, a suburban-style shopping center flank the station (see Figure 5.10).

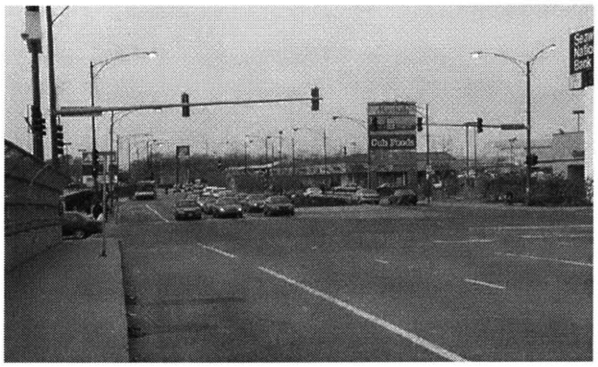

Figure 5.10

Auto-oriented shopping center at 87th Station

(view: on 87th Street looking west from station headhouse)

A wide variety of commercial activity is present, including "big box" retailers: a supermarket, discount chains, a large-scale building materials outlet, banks and restaurants. While a few of the retailers (e.g. the hardware store) are not likely to serve large numbers of patrons arriving by transit, such a varied and large collection of stores and shops near a transit station could be a boon to the transit rider. Unfortunately, the shopping center is oriented to automobile access. The pedestrian must find a long, unclear route across large parking lots to reach most tenants. Sidewalks and pedestrian paths are missing (see Figure 5.8). In addition, major stores are located on both sides of 87th Street, and crossing its six lanes is quite formidable. The exposure to traffic and lack of pedestrian-scaled lighting raises concerns about safety and security.

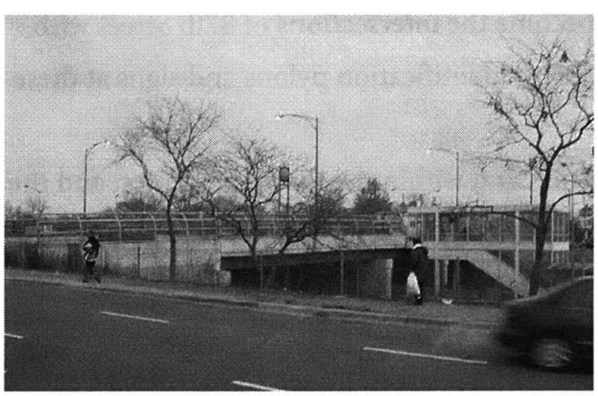

Figure 5.11

Sidewalk is missing where pedestrians desire to walk

(view: on Lafayette Avenue looking east to station headhouse, right)

Station Inadequately Identified

A residential neighborhood of gridded streets lies to the east, where better walking conditions can be found. However, the station's nondescript headhouse is not identified by prominent signage, and there are no signs directing the way to it. Maps of the station area are nonexistent.

A Pedestrian-Oriented Future

Despite the limitations imposed by the expressway, much can be done to improve the walkability of the area and encourage residents, workers, and shoppers to walk to the station and use transit. The catchment area of the shopping center currently extends well beyond the immediate neighborhood, facilitated by convenient auto access and abundant parking. Improved connections to 87th Station will offer transit riders a comparable level of convenience.

- This will raise the competitiveness of the shopping center tenants, attracting transit riders that other retail centers away from stations cannot.
- New riders will be attracted to CTA as many errands can be incorporated into transit trips.
- Residents of the neighborhood east of the expressway will benefit from improved access to transit as well as to shopping.

Raising the Station's Profile (Short-term)

The presence of the station would be more obvious.

- The points of entry to the station would become the intersections of 87th Street with Lafayette Avenue and with State Street. System identification pylons and signs at these locations would create this effect.
- Area maps would be introduced at the station and within the shopping center, and the businesses would identify their location prominently with the name of the station.
- A more descriptive and inclusive station name than "87th" would be considered.

Redesign of the 87th Street Overpass (Short and Mid-term)

Walking conditions on the expressway bridge would be improved. Enhanced sidewalks would better link the intersections across the bridge to the existing headhouse and to an additional one on the north side of 87th Street.

- A landscaped strip, or a low wall with attractive architectural detailing, would provide a buffer between the sidewalk and traffic.
- A matching treatment would replace the existing chain link to provide a more attractive and dignifying experience for pedestrians.
- The legs of both intersections would be improved for better pedestrian safety and comfort. Crosswalks and signals would be made more legible, where necessary, and neckdowns and shortened curb radii would make crossing distances shorter.
- The median of 87th Street west of Lafayette Avenue would be extended to the intersection to provide a refuge for crossing pedestrians and calm traffic.

Redesign of the Shopping Center (Long-term)

Pedestrian access to the shopping center would assume greater importance.

- Outparcels would be developed, defining an edge to 87th Street and Lafayette Avenue. This would allow semi-public spaces oriented to the street, such as sidewalk cafés or restaurants with outdoor seating.
- Walkways would be introduced through the parking lots, facilitating direct pedestrian routes clearly marked by landscaping and crosswalks.
- The shopping center would allow second-floor offices and, as needs and markets change, the area would gain more of a mixed-use character.
- The desirability of the location would eventually prompt some of the surface parking to be replaced with structures, freeing space for these additional uses, particularly adjacent to transit.

Specific interventions are summarized in Table 5.5 on the following page:

Table 5.5

87th

Red Line
Dan Ryan Branch

87th serves the Chatham area of southern Chicago. To the west, the station is flanked by an industrial area and, closer in, a suburban-style shopping center. To its east lies a residential neighborhood of gridded streets. Pedestrian access is compromised primarily by the station's location in the median of the Dan Ryan Expressway and the auto-orientation of the strip mall, whose major retailers draw customers from beyond the neighborhood.

qualities	**interventions**		
	short-term	mid-term	long-term
Directness of Pedestrian Routes		• introduce pedestrian walkways through strip mall parking lots	• build an additional entrance on the north side of 87th • introduce outparcel uses at the NW/SW corners of Lafayette/87th
Continuity and Integrity of Pedestrian Routes	• construct sidewalk on E side of Lafayette	• implement pedestrian walkways through strip mall parking lots	
Ease of Crossing Streets	• introduce additional crosswalks on Lafayette S and N of 87th and on 87th W of Lafayette • install midblock xing at entrance for bus stop	• extend median of 87th to Lafayette, include generous space for crossing pedestrians	• shorten curb radii/neckdowns on Lafayette and 87th
Perception of Safety and Security		• replace chain link on bridge over Dan Ryan with more attractive solution	• introduce landscaped strip in parking lane over Dan Ryan to calm traffic, buffer peds, and add interest/beauty AND/OR build headhouse extensions to sides of expwy bridge
Provision of Information and Identification	• install system icon at station entrance • engage relationship between CTA and strip mall tenants	• install identification pylons at Lafayette and State intersections • encourage tenants to note station in ads • install station area maps identifying tenants	• install orientation maps throughout strip mall denoting station
Urban Vitality		• introduce pedestrian amenities along 87th (e.g. street furniture)	• encourage infill of strip mall parking lots with pedestrian-oriented uses

5.3.3.2 Medical Center

Existing Conditions

Station Context

Medical Center is located in the median of Eisenhower Expressway, which blocks access to the station's surroundings. Development has never oriented itself around the station due to the inhospitable expressway. Important destinations are within walking distance:

- the UIC and West Side Medical Center campuses, for which the station is named;
- Malcolm X College, one of Chicago's city colleges; and
- United Center, a large sports arena drawing much special events traffic.

While dominated by these large facilities and their attendant parking lots, the area is also interspersed with residential properties.

Expressway Bridges

The station benefits from having three entrances, at three different streets. These must be reached by crossing long bridges over the wide expressway and its on- and off-ramps. The Ogden Avenue Bridge is especially long because it crosses the expressway at an angle (see Figure 5.12).

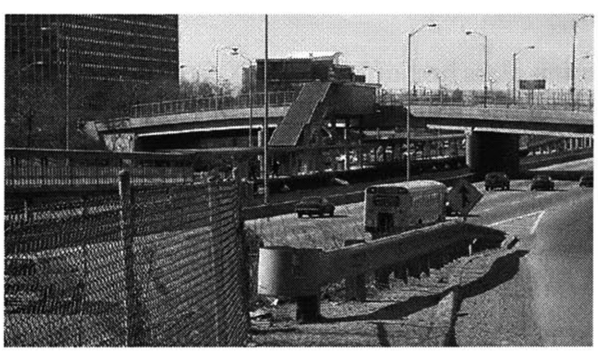

Figure 5.12

Medical Center Station headhouse at Ogden Avenue

(view: on Paulina Street looking east)

At this location, street geometry hinders walk-up access, as pedestrians must take indirect routes to cross intersections at the approaches to the station and reach the headhouse.

The cross streets where the headhouses are located are over-dimensioned, leaving the pedestrian exposed in a sterile, concrete environment (see Figure 5.13).

Figure 5.13

Pedestrians crossing Ogden Avenue to and from headhouse

(view: southwest)

Approaching the Station from the South

Beyond the expressway and Congress Parkway, walking is hindered by sidewalks in ill repair and impeded by utility elements in the pedestrian clear zone. Between the medical center and the Congress Parkway, a park has a peripheral atmosphere that may raise security concerns at certain times of the day. Little of its surroundings seem to address or survey it. Once within the medical center campus, walking becomes more comfortable with well-defined walkways, buildings addressing the street, and the presence of many other pedestrians.

Approaching the Station from the North

On the north side of the expressway, the Miesian glass box of Malcolm X College is set back far from the street and seems to disregard the pedestrian, although it can be seen from the station platform and remains in the field of view as it is approached from the station. United Center, on the other hand, is not indicated by any signs at or outside the station. While it can be seen from the Ogden Avenue Bridge, it is difficult to discern, let alone the appropriate route to get there. Parking lots and other marginal uses make this area void of much pedestrian activity, except before and after special events.

A Pedestrian-Oriented Future

The expressway presents significant challenges to pedestrian access, but the number and mix of destinations in the area provide a fertile ground for germinating a walkable station environment. Strong connections to the facilities of regional importance nearby are envisioned for the station.

- This allows the institutions to grow without putting pressure on adjacent neighborhoods.
- Accessibility to the institutions is still accommodated by the automobile, but transit becomes a competitive alternative.
- The need for additional parking in the area can be reduced.
- New jobs and activity in the area will contribute to its revitalization.

Raising the Station's Profile (Short-term)

The station's presence would be more apparent.

- The points of entry to the station would move out to the intersections of Damen Avenue, Ogden Avenue and Paulina Street with Van Buren Street and Congress Parkway. This would be achieved by means of system identification pylons and signs at these locations.
- Area maps would be introduced throughout the area, integrating with wayfinding systems developed by the institutions to guide access to and from the station and within their individual buildings.
- A new identity for the area would be forged, possibly including a new name for the station, more inclusive of the area's multiple destinations than "Medical Center."

Sidewalk Improvements and Traffic Calming (Mid-term)

Walking conditions on the streets crossing the expressway would be improved.

- Sidewalks from the intersections of the cross streets with Congress Parkway and Van Buren Street to the station headhouses would be enhanced, using some of the space now wasted as unused parking lanes on the cross streets.

- A landscaped strip, or a low wall with attractive architectural detailing, would provide a buffer between the sidewalk and traffic on Damen Avenue, Ogden Avenue and Paulina Street.
- Chain link would be replaced by a more attractive and dignified solution along the bridges.
- Signals at Ogden Avenue's awkward angled intersections would introduce a phase allowing diagonal pedestrian crossings.
- Bulbouts would be introduced into the parking lanes, calming traffic and reducing pedestrian crossing distances.
- Throughout the area, crosswalks would be better defined with improved signage and markings.
- Sidewalks would be repaired, reconfigured or built as necessary.

New Zoning Encourages Pedestrian-Oriented Mixed Uses (Mid-term)

The existing institutions orient themselves toward the station through new construction and intervening mixed uses, with Wood Street as a spine of development.

- Expansion of the institutions or supporting offices would fill in the gaps between them and the station.
- Zoning and incentives would attract mixed uses to the area, adding more residential use. This would be focused along Wood Street and be especially attractive for students and employees of the nearby institutions.
- Maximum setbacks would be instituted to bring buildings up to the sidewalk.
- Minimum parking requirements would be relaxed, and conversion of surface parking into structures would be encouraged.
- An entertainment and restaurant district would develop around United Center, making urban vitality and pedestrian activity a daily matter-of-fact.

New Pedestrian Corridor on Wood Street (Long-term)

An extended Wood Street forges direct connections for pedestrians and ties the area's institutions together.

- A new Wood Street Bridge would cross the expressway, connecting United Center, Malcolm X College, the station, and the medical center campus. Cars would be allowed to the edges of the bridge to facilitate access, but through traffic across the bridge would not be permitted.
- The triangular portion of the expressway formed by the Wood Street Bridge, Congress Parkway and Ogden Avenue would be decked over to create parcels for shops and office buildings above the station and expressway. A hotel or even apartments and condo-miniums are conceivable for the side of the triangle along Congress Parkway, as views would look out over the park, not at the expressway, and noise would be buffered accordingly.
- The deck over the expressway would help to bridge the neighborhoods on either side, and could generate revenue for CTA and/or IDOT through the sale of air rights.
- Streetfront stores and offices would define the edge of the Wood Street corridor, frame the north side of the park, and address Ogden Avenue.
- A new "main" station entrance would be integrated into the mixed uses at the Wood Street Bridge, providing more direct routes of access to the station than Ogden Avenue currently does.

Specific interventions are summarized in Table 5.6 on the following page:

Table 5.6

Medical Center

Blue Line
Forest Park Branch

Medical Center serves the UIC and West Side Medical Center campuses as well as Malcolm X College and United Center near the Tri-Taylor district of central Chicago. While dominated by these uses and their attendant parking lots, the area is also interspersed with residential properties. Pedestrian access is compromised primarily by the station's location in the middle of the Eisenhower Expressway and the traffic entering and exiting the expressway and on Ogden and Damen.

qualities	**interventions** short-term	mid-term	long-term
Directness of Pedestrian Routes	• introduce diagonal crosswalk from SE to NW corner of Ogden/Van Buren		• extend Wood across expressway and develop it as pedestrian corridor between United Center and UIC campus, introduce new "main" entrance at Wood
Continuity and Integrity of Pedestrian Routes	• repair/replace sidewalks on Wood between Jackson and Monroe	• relocate utility poles out of pedestrian clear zone at corners of Ogden/Van Buren	
Ease of Crossing Streets	• introduce diagonal crosswalk from SE to NW corner of Ogden/Van Buren • improve markings and signage at crosswalks		• shorten curb radii/neckdowns on Ogden, Damen and Paulina intersections
Perception of Safety and Security		• replace chain link on bridge over Eisenhower with more attractive solution	• introduce landscaped strip in parking lane over Eisenhower to calm traffic, buffer peds, and add interest/beauty
Provision of Information and Identification	• install system icon at station entrances • engage relationship between CTA and hospitals, college, United Center • reevaluate station name, install new signs	• install identification pylons along Congress and Van Buren • encourage institutions to note station in ads • install area maps identifying institutions	• install orientation maps on campuses/grounds denoting station's location
Urban Vitality		• offer station concessions at entrances • introduce pedestrian amenities along Ogden, Damen and Paulina (e.g. street furniture)	• deck over expressway between Ogden and Wood for mixed uses integrated with station • consolidate parking in structures, use land gained for streetfront mixed uses

5.3.3.3 North/Clybourn

Existing Conditions

Station Context

North/Clybourn Station serves the gentrifying west end of the Old Town district of central Chicago. It is a subway station; there are no expressways, embankments, or other such obstacles to pedestrian access as at the expressway median stations. Nonetheless, it suffers from impediments to pedestrian access despite its location in a commercial district surrounded by residential neighborhoods.

Poor Identification of Station Headhouse

The station headhouse is very unobtrusive, so that many would-be transit patrons likely look unsuccessfully for a station somewhere along the elevated line nearby that has no stop. The area has many retail establishments including several upscale chain stores that make this station very convenient for the transit shopper. These, however, are not readily apparent as one exits the station.

Awkward Orientation of Station Headhouse

The station headhouse is located on the triangular block formed by West North Avenue, North Clybourn Avenue, and North Halsted Street. It faces a driveway in the middle of the block separating it from the gas station that it shares the block with (see Figure 5.14). This arrangement not only obscures the station entrance, but places exiting riders in a rather unattractive environment.

Figure 5.14

North/Clybourn Station's headhouse (center) shares an irregular block with a gas station (left)

(view: on North Avenue looking west)

Difficult Crossing Conditions

To reach anything other than the gas station, pedestrians must cross one of the three streets bounding the headhouse. No midblock crosswalks are provided, so the temptation is great to sprint across the street when there are breaks in traffic (see Figure 5.15). Even when pedestrians walk to one of the three corners with signalized crossings, markings are unclear or nonexistent, and signals are awkwardly positioned. There is little waiting space and the sidewalk offers the pedestrian few amenities.

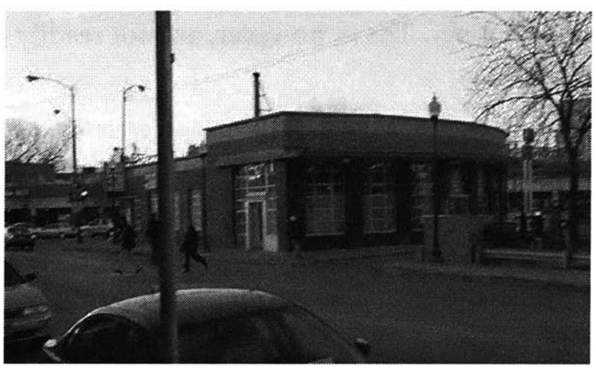

Figure 5.15

The midblock location of the entrance encourages jaywalking

(view: on Clybourn Avenue looking north)

Auto-Orientation of Surrounding Commercial Activity

While many of the surrounding commercial establishments address the street with entrances on the sidewalk, some have taken the form of suburban strip malls, set back by parking lots. In these locations, sidewalks lack definition and curb cuts interrupt the sidewalk. Across Clybourn Avenue and east of Dayton Street, a vacant lot provides a shortcut for transit patrons walking from the residential neighborhood to the south, but its appearance raises security concerns. Though the station likely met pedestrian needs very well when first built, including a second entrance at Dayton Street, the encroachment of automobile-oriented uses and designs (e.g., the gas station, strip centers) have deteriorated the headhouse's prominent position in the neighborhood and marooned it in the middle of traffic.

A Pedestrian-Oriented Future

The area around the station is already quite walkable, but the encroachment of the automobile has compromised pedestrian activity. In the future this trend would be reversed, and the station would become the center of a walkable community.

- Currently undergoing gentrification and revitalization, the neighborhood is in need of a focal point. The station would provide an enduring anchor as change continues.
- Because rapid transit is below ground at this location, the parcels above it are very convenient to the station. This proximity can be exploited to attract development bringing the most potential ridership to CTA.

Raising the Station's Profile (Short-term)

The station would assume a more prominent presence in the neighborhood.

- The station would be prominently identified, both at the headhouse itself and with pylons at each of the three intersections.
- Area maps would be introduced at the station and along adjoining streets, perhaps in conjunction with a improvement district formed by area businesses.

Sidewalk Improvements and Traffic Calming (Mid-term)

In the interim, midblock crossing conditions must be improved awaiting new station entrances at the corners of the block.

- Midblock crosswalks are provided along pedestrian desire lines.
- Enhanced and realigned markings and signals are provided at the intersections.
- Sidewalks along the existing headhouse are widened and enhanced with street trees or landscaping, street furniture, and other amenities.
- Clearly defined walkways would connect through to the surrounding neighborhoods.

New Zoning Encourages Pedestrian-Oriented Mixed Uses (Mid-term)

The current trend toward automobile-orientation is reversed through zoning and incentives.

- New zoning and/or an overlay district sets the stage for the long-term transformations described above.
- Maximum setbacks are established on adjoining streets to encourage streetfront orientation of buildings.
- Outparcel development is allowed on existing parking lots.
- Parking behind buildings and in structures is encouraged.

An Urban Activity Center at North/Clybourn (Long-term)

The block now occupied by the station headhouse and a filling station is transformed into an activity center with significance reaching beyond the surrounding neighborhood.

- The headhouse would be redesigned to orient itself to the exterior, rather than the interior of the block. The convoluted path to the subway platforms would be made more direct and intuitive so that a shorter distance of access is perceived.
- The gas station would be replaced with pedestrian-oriented mixed uses integrated with the redesigned headhouse. This prominent location would be ideal for a large entertainment venue, such as a cineplex.
- Floors above the station circulation area and ground-floor shops would house offices or other appropriate uses.
- The vacant lot south of the headhouse between Dayton Street and Clybourn Avenue would become an attractive public plaza, incorporating a Dayton Street entrance that no longer exists but can be reintroduced by knocking out a sealed-off passage.

Specific interventions are summarized in Table 5.7 on the following page:

Table 5.7

North/Clybourn

Red Line
Howard Branch

North/Clybourn serves the gentrifying west end of the Old Town district of central Chicago. This subway station lies under Clybourn, paralleled by a snaking elevated line that makes no stop in the area. The unobtusiveness of the station likely has many pedestrians looking, unsuccessfully, for a station somewhere along the elevated tracks. The area has many retail establishments, including several upscale chain stores that make this station very convenient for the transit shopper.

qualities	**interventions**		
	short-term	mid-term	long-term
Directness of Pedestrian Routes	• install midblock crossings of North and Clybourn	• introduce walkway through lot at SE corner of Clybourn/Dayton	• reopen Dayton entrance • build additional station entrances (NW corner of Clybourn/Dayton, at Halsted) • *see also Urban Vitality below*
Continuity and Integrity of Pedestrian Routes		• introduce pedestrian walkways through strip mall parking lot (N side of North) • widen sidewalks along North and Clybourn around existing headhouse	
Ease of Crossing Streets	• realign of ped signals/markings at North/Dayton intersection • improve markings and signals at North/Clybourn/Halsted/Dayton		• reopen Dayton entrance • build additional station entrances (NW corner of Clybourn/Dayton, at Halsted)
Perception of Safety and Security		• install new pedestrian-scaled lighting along North/Clybourn/Halsted/Dayton	
Provision of Information and Identification	• install system icon at station entrance • engage relationship between CTA and surrounding retailers	• install identification pylons at all intersections of North/Clybourn/ Halsted/Dayton • install station area maps	• install orientation maps throughout business district denoting station
Urban Vitality		• introduce pedestrian amenities along North/Clybourn/Halsted/Dayton (e.g. street furniture)	• replace gas station sharing block with headhouse with pedestrian-oriented mixed-use, extend entrances out to block corners, encourage parking relocation to back of existing retail uses/develop outparcels, structured parking

5.3.3.4 Irving Park

Existing Conditions

Station Context

Irving Park Station serves the urban Albany Park neighborhood of northwestern Chicago. Pedestrian access is compromised primarily by the station's location in the median of elevated Kennedy Expressway and an adjacent railroad embankment for Metra commuter rail. The expressway is the main gateway to the city from the north and from O'Hare International Airport, and accommodates heavy traffic throughout the day.

Expressway Underpasses

Station entrances are under the expressway's bridges over West Irving Park Road and North Pulaski Road, both of which have interchanges with the expressway. Thus pedestrian access is very compromised by the impacts of traffic.

- The station entrances are not easily discernable and the environment under the bridges is very unpleasant (see Figures 5.16 and 5.17).

Figure 5.16

Station entrance at Pulaski Road

(view: looking south)

- The exposed beams forming the overpasses provide a popular nesting ground for pigeons, whose droppings cover the sidewalks.
- The limited space is cluttered with utility elements and is filled with the sound of roaring traffic.
- Under the expressway, Pulaski Road is reasonably well-lit; however, Irving Park Road is quite dim (see Figure 5.17).

Figure 5.17

Dimly-lit conditions under Kennedy Expressway along Irving Park Road

(view: looking west)

- Station exits on the north side of Irving Park Road and the east side of Pulaski Road provide shortcuts, but entering the station requires crossing one of those two busy arterials.
- Midblock crossings are barely recognizable to the pedestrian, let alone motorists.

Beyond the Expressway

Emerging from under the expressway, the pedestrian encounters a myriad of obstacles:

- on- and off-ramps
- sidewalks in ill repair
- encroachments into the pedestrian clear zone
- unclear crosswalk markings
- curb cuts into automobile oriented uses, particularly gas stations.

However, once beyond the arterials, pedestrian-oriented residential streets prevail and walking conditions are much improved.

A Pedestrian-Oriented Future

A pedestrian-oriented context of mixed uses oriented to gridded streets exists around Irving Park Station. Unfortunately this has been overwhelmed by the heavily trafficked expressway and feeder arterials. In the future the Irving Park Road/Pulaski Road intersection assumes the role of a walkable neighborhood center with a strong connection to the nearby station.

- With commuter rail, rapid transit, and buses converging at the station, this is an important intermodal transfer center as well as an expressway interchange. Equity is addressed as needs of transit riders are balanced with those of motorists.
- An activity center can meet the needs of commuters transferring between modes and provide a focal point and identity for the immediate neighborhood.

"First Aid" for Better Pedestrian Access (Short-term)

Before the significant changes outlined above are implemented, a number of short-term solutions can improve conditions considerably.

- Regular cleaning and maintenance of the sidewalks under the expressways is a primary concern. Means of deterring pigeons are undertaken.
- Better lighting, including reflective painting or finishing of surfaces, would improve the dim environment under the expressway.
- The midblock crossings under the expressway are more clearly defined with new markings and signage.
- Sidewalks along Pulaski Road and Irving Park Road would be cleared of obstructions, repaired and replaced.
- The expressway bridge faces become the de facto station entrances and would be prominently identified as such with new signage.
- Pylons indicating the presence of the station would be placed at the Irving Park Road/Pulaski Road intersection and on both arterials on the far side of the Metra commuter rail embankment.

Redesign of Expressway Underpasses and Approaches (Mid-term)

The miserable conditions existing under the expressway are ameliorated through several design interventions.

- A suspended ceiling would seal off the areas where pigeons now roost and support periodic bridge inspections.
- The suspended ceiling would present the opportunity for improved lighting and art and architectural elements that would enliven the dead space under the expressway and make perceived distances shorter.

- The introduction of additional, unmanned station entrances at the far ends of the station (north side of Irving Park Road, east side of Pulaski Road) where exits are currently provided would shorten pedestrian routes and allow the dangerous midblock crossings under the expressways to be discontinued.
- A low wall with pedestrian-oriented detailing is placed along the sidewalks under the expressway, with breaks for bus stops, shielding pedestrians from the spray and debris generated by traffic.
- The possibility for removal of the abutments under the expressway along Irving Park Road is explored, reclaiming space that could be used for bus lanes, bicycle parking, or concessions. This would add activity and interest to this forlorn location.
- Traffic calming interventions would bring expressway traffic to slower speeds before it meets Irving Park Road and Pulaski Road, and crosswalks and signals would be improved to give pedestrians more direct and frequent service.

New Zoning Encourages Pedestrian-Oriented Mixed Uses (Long-term)

To create a walkable neighborhood center at Irving Park Road and Pulaski Road, new zoning and pedestrian-oriented features are necessary.

- A landscaped strip or street trees between the sidewalk and the street along Irving Park Road and Pulaski Road would buffer pedestrians and beautify the area.
- Curb cuts would be consolidated where possible, and zoning would encourage development oriented to the street.
- In particular, the gas stations at the Irving Park Road/Pulaski Road intersection would be relocated and/or redesigned. While the junction of two major arterials with an expressway is a prime location for filling stations, the current configuration is very disruptive to a pedestrian-friendly environment. As a compromise, gas stations could be allowed at midblock locations
- The return of buildings framing all four corners of the intersection would be encouraged.

Specific interventions are summarized in Table 5.8 on the following page:

Table 5.8

Irving Park

Blue Line
O'Hare Branch

Irving Park serves the urban Albany Park neighborhood of northwestern Chicago. Pedestrian access is compromised primarily by the station's location in the median of the elevated Kennedy Expressway and the Metra commuter rail line running parallel to it. Heavy traffic enters and exits the expressway at Pulaski and Irving Park, placing the station entrances very literally in the middle of a freeway interchange. Retail establishments are found along Pulaski and Irving Park, beyond which lie residential areas.

qualities	**interventions**		
	short-term	mid-term	long-term
Directness of Pedestrian Routes	• provide for entering the station at the exits on N side of Irving Park and E side of Pulaski		
Continuity and Integrity of Pedestrian Routes	• remove clutter under Kennedy at Pulaski entrance • relocate clutter out of pedestrian clear zone along Irving Park	• repair/replace sidewalks along Irving Park and Pulaski (particularly under Metra bridge over Pulaski)	
Ease of Crossing Streets	• improve markings and signage at crosswalks		• install traffic calming devices at expressway entrances and exits (e.g. bulbouts)
Perception of Safety and Security	• institute regular cleaning of sidewalks under Kennedy bridges over Irving Park and Pulaski, introduce pigeon deterrents	• install new and improved lighting under Kennedy bridges along with suspended "ceiling" to solve pigeon problem yet still allow crews to inspect bridge beams	• remove inclined abutments under Kennedy bridge over Irving Park to provide more sidewalk space, buffer pedestrians and add art/concessions for interest/activity
Provision of Information and Identification	• install system icon on bridge faces at Irving Park and Pulaski so that these become the de facto station entrances	• install identification pylons on far side of Metra tracks, at Irving Park/Pulaski intersection • install station area maps	
Urban Vitality		• offer station concessions at entrances/ under Kennedy • introduce pedestrian amenities along Irving Park and Pulaski (e.g. street furniture)	• change zoning to encourage replacement of auto-oriented uses (particularly gas stations) along Irving Park and Pulaski with streetfront mixed uses

5.3.4 General Applications

The following examples illustrate possibilities for improving pedestrian access to stations. They represent successful means of resolving common impediments found at the four case study stations, and shared by many other CTA stations. They may be readily applicable to the case study stations, and as success is demonstrated at these locations, experience will be gained for application to other stations throughout the system. Short- to mid-term interventions for consideration are:

- Emphasizing the Station in the Streetscape
- Calm Streets and Improved Sidewalks and Intersections
- Straightforward Routes through Parking Lots
- Clear Orientation Devices

A final application

- Mixed Land Uses and Pedestrian-Scaled Streets

involves mid- to long-term efforts.

5.3.4.1 Emphasizing the Station in the Streetscape

The Hudson-Bergen Light Rail System in Jersey City and Bayonne, New Jersey, employs an innovative means of identifying stations and guiding patrons to their location, typically offset from the street in a railroad right-of-way (see Figure 5.18).

- Pylons with a backlit New Jersey Transit logo are positioned along neighborhood streets and cast light upward, becoming welcoming beacons for the stations.
- Pavement treatments, distinctive lighting elements, and other street furniture then forge a connection between the pylons and the "isolated" stations.
- Finally, the station "entrances" are emphasized with prominent signage and lighting.

Figure 5.18 *Pylon marks station at street within neighborhood (left); attractive plaza (center) creates connection between neighborhood street and the platform (right)*

Application to Chicago (Short- to Mid-term)

Signage and symbols identifying rapid transit is minimal or non-existent in Chicago. The Hudson-Bergen strategy has direct application to each of the expressway median stations (87th, Medical Center, and Irving Park). These stations would "reach out" with pylons or other station markers placed at the nearby intersections and attractive elements would lead the way to the entrances in the median.

While North/Clybourn Station does not have to "reach out" to the same degree as the others, prominent signage would emphasize the station entrance (see Figure 5.14; note how clearly the gas station is identified as compared to the station headhouse).

5.3.4.2 Calm Streets and Improved Sidewalks and Intersections

High-volume arterials intimidate pedestrians and crossing opportunities are often infrequent. Midblock crosswalks and neckdowns are important to improving pedestrian access to stations (see Figure 5.19). In the example below, space in an irregular intersection that typically would be asphalt becomes an attractive public plaza. This allows crossing distances to be shorter and directs motorists to watch for pedestrians and slow down.

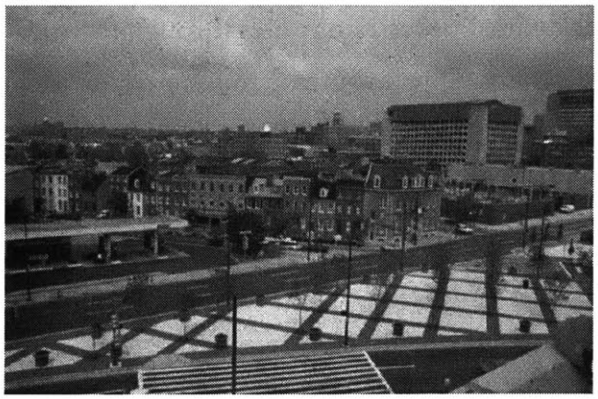

Figure 5.19

A plaza introduces and reclaims pedestrian space in an intersection; note short crossing distance at intersection (right) and the generous midblock crosswalk (center)

Application to Chicago (Short- to Mid-term)

Traffic calming around the case study stations would encourage pedestrian access and improve pedestrian safety. Intersection improvements, including neckdowns and signal retiming to maximize WALK opportunities, would reduce crossing distances and delays.

- At 87th and Medical Center Stations, the parking lanes of streets crossing the expressways are continued across the bridges but are unused. This space can be reclaimed for pedestrian use, calming traffic by reducing the space available for it. This has been done on the recently reconstructed Madison Street Bridge over the Kennedy Expressway.
- A public plaza similar to the one above between Clybourn Avenue and Dayton Street would dramatically change the environment around North/Clybourn Stations. This would reduce crossing distances and provide an appropriate context for reestablishing the auxiliary station entrance that no longer exists.
- A quick improvement of pedestrian access to Irving Park Station would be achieved with clearly-defined midblock crossings similar to the one pictured above.

5.3.4.3 Straightforward Routes through Parking Lots

Traffic moves slower in parking lots, but well-defined pedestrian routes through them remind motorists to share the space with pedestrians. Direct routes through parking lots encourage walking and boost pedestrian confidence (see Figure 5.20). Littleton/Downtown Station, discussed in section 3.3.2, offers parking for transit patrons but does not neglect the needs of pedestrians.

Figure 5.20

The way through this parking lot to Littleton/Downtown Station (historic depot "headhouse" at center) is direct, and well-defined through the use of colored concrete

Application to Chicago (Short- to Mid-term)

Parking lots abound in the case study station areas, yet they need not preclude pedestrian access. The loss of a few parking stalls through reconfiguration and establishment of pedestrian pathways will encourage both better motorist behavior and more pedestrian activity.

- At 87th Station, pedestrian routes through parking lots to the shopping center tenants will reduce perceived distances and automobile-caused intimidation of pedestrians.
- At North/Clybourn Station, pedestrian routes through strip mall parking lots can establish a framework for future infill or reconfiguration of development.

4.3.4.4 Clear Orientation Devices

A University of Illinois at Chicago campus map outside the UIC-Halsted station helps transit riders exiting the system find the way to their ultimate destination on campus (see Figure 5.21). Wayfinding systems in other cities are accomplished through a variety of funding and sponsorship programs. WMATA installs station area maps on the platforms and mezzanines in all of its Metro stations. Directly outside a few of the Metro stations, other entities (including a business improvement district, a municipality, and the National Park Service) have posted area maps funded independently of WMATA. Simple and low-cost updating of area maps is essential to their success.

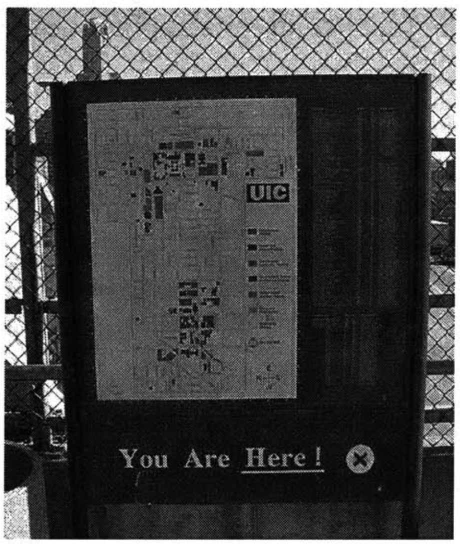

Figure 5.21

Specialized station area map at UIC-Halsted Station

Application to Chicago (Short- to Mid-term)

Station area maps are standard equipment in many transit systems. CTA has yet to install them in its stations, although wayfinding systems to surrounding attractions are found in some locations. Ideally, all stations should be outfitted, both inside and outside paid areas, with station area maps in a consistent format. Two of the case study stations would especially benefit from area maps.

- At 87th Station, maps of the shopping center—patterned after the floor plan maps typically found in enclosed shopping malls—could be placed throughout the center and at the station, indicating at a glance all of the goods and services available and the route to get there.

- At Medical Center Station, maps indicating the various institutions and destinations in the area would raise one's awareness of the convenience of transit.

5.3.4.5 Mixed Land Uses and Pedestrian-Scaled Streets

Mixed uses and a streetfront presence for development can ameliorate the automobile-dominated atmosphere around expressways. Rockridge BART Station in Oakland, California, is located in a freeway median yet is steps away from sidewalk-fronting shops with office space above (see Figure 5.22). As a result, the station seems much nearer to the surrounding neighborhood, and the vitality and activity of shops and restaurants so near makes the walk under the expressway much more tolerable.

Figure 5.22

Pedestrian-oriented mixed-use (left) adjacent to Rockridge BART Station (located in the median of the freeway at right)

Application to Chicago (Mid- to Long-term)

North/Clybourn Station already enjoys a healthy mix of uses and pedestrian-orientation around it, but these are poorly related to the station headhouse. The expressway median stations are almost devoid of supporting mixed uses.

- At 87th Station, offices and even apartments could eventually be integrated into the existing single-use commercial strip in upper floors or outparcels, defining the streets as does the mixed-use building at Rockridge BART Station.

- Long pedestrian routes between Medical Center Station and the surrounding destinations would be perceived as being shorter and more sheltered with neighborhood retail establishments and restaurants. Currently there are few examples of these, although a ready market exists for them among the concentration of employees, students, and event visitors in the area.
- The many transit riders at Irving Park Station would benefit from a more pedestrian-friendly, less automobile-dominated intersection of Irving Park Road and Pulaski Road. Shops and offices along those streets, as on the one leading to Rockridge BART Station, offer the opportunity for trip-chaining.

5.4 Conclusion

Each of the six case study stations face different challenges and opportunities for improving pedestrian access. Some general challenges affect all stations. Sidewalk sweeping is needed regularly, as is snow shoveling in the winter months in Chicago. Light fixtures and security devices require regular examinations and periodic replacement of parts. Signals and timing devices must also be checked and reprogrammed when necessary. Construction of new facilities can compromise capacity and require mitigation and detours.

Examples of successful interventions from other locations suggest how strategies to improve pedestrian access might be directed around Tren Urbano and CTA rapid transit stations. Creating pedestrian-friendly environments around them will entail years of ongoing effort, but can be achieved incrementally using a phased approach of short-term, mid-term, and long-term interventions as set forth for each station.

Chapter Six
CONCLUSION

6.1 Summary

This thesis has focused on the pedestrian-unfriendly environments where many new transit stations are sited, and the implications these surroundings have on walking as an access mode. The research was motivated by the following concerns with respect to the resurgence of rail transit in the United States:

- To avoid complicated land acquisition procedures and costly alignment alternatives, established highway and railroad corridors have overwhelmingly been the right-of-way of choice for new rail transit lines. Some projects would not even be feasible if these less expensive alignment options were not available. While the stations placed along these alignments can function reasonably well with park-and-rides and feeder bus routes, pedestrian access is often disregarded.

- America's new transit lines are often introduced in areas where development has been built with the automobile in mind, where low densities and segregated land uses prevail. Even when origins and destinations are nearby, the lack of pedestrian-friendly facilities and conditions discourages walking to them from stations.

- While rail has been enthusiastically accepted in many cities and boosted transit ridership, "success" in the form of reduced congestion and pollution has not been as apparent. New, compact development oriented around stations has been spotty, while sprawl continues unabated. The potential for many more trips to be taken by transit, and for growth to occur as infill in transit corridors, is missed as the needs of pedestrians have been neglected.

Based on these observations, this research has sought to determine what the benefits of improving pedestrian access to stations are; how it can be achieved; and what the application of these findings on a number of existing and future transit stations might be.

This research has not advocated that walking should supplant all other modes of access to transit stations, or even that the pedestrian-transit trip must regain the ubiquity it once enjoyed in urban America. Instead, it has described areas of great potential—contributing to transit's viability as well as bringing wider benefits to the communities served by transit—that can be tapped as the needs of pedestrians walking to stations are recognized and accommodated in transit system planning, construction, and rehabilitation.

6.2 Guidelines for Improved Pedestrian Access to Stations

Based on observed levels of pedestrian activity in various urban areas, qualification and quantification of walking conditions in those areas, and the experiences of transit stations around the country, the factors influencing walking as a mode of access have been analyzed. The many possible considerations have been distilled into the following eighteen guidelines:

- Sidewalks and paths leading to transit stations should be direct: they should match pedestrian desire lines. Out-of-direction travel should be avoided wherever possible.

- Pedestrian bridges and tunnels should be used sparingly—only when necessary. Movements between various levels should be kept to an absolute minimum.

- Stations should incorporate multiple entrances, or include the possibility for their future installation.

- Sidewalks should be in place along all streets within at least a 500 meter (one-third mile) radius of the station.

- Sidewalks within the station area should be sufficiently wide, at least 1.83 m (6 ft) between encroaching elements, and wider where there is increased pedestrian activity.

- Curb cuts for driveways should be limited along new sidewalks in the station area, and minimized through consolidation and reconfiguration along existing facilities.

- Crossing opportunites should match pedestrian desire lines. Where these do not coincide with an intersection, midblock crosswalks should be implemented.

- Crosswalks should be clearly marked, both for motorists and pedestrians; signals should be timed to maximize "green time" for crossing pedestrians.

- Traffic calming measures should be undertaken along pedestrian routes leading to stations, including neckdowns/bulbouts at crosswalks and on-street parking.

- Sidewalks and pedestrian routes to stations should be well lighted. Light fixtures should be specified and positioned with pedestrian needs in mind.

- Sidewalks should be maintained, regularly cleaned and kept cleared of snow. Abutting walls or fences should be kept free of graffiti.

- Pedestrian routes should be in view of homes, shops and offices and should offer unobstructed lines of sight between cross streets.

- Signage and maps within stations should provide clear information about the surroundings and guide transit riders to the exit nearest their destination.

- Station area maps should be available on platforms, mezzanines, and entrances, as well as at remote locations.

- Stations should be well identified in the streetscape, and at remote locations other than the immediate entrances.

- Pedestrian activity should be fostered in station areas through development of higher density than single-family homes and "drive-thru" commercial strips.

- Mixed-uses should be encouraged in station areas, particularly integrating residential, retail, and office uses within the same buildings.

- Buildings in station areas should be brought up to sidewalks and parking placed behind or to the side of them; street furniture and amenities should be provided.

Constant among the surveys, studies, and observations that have contributed to this research has been the critical need to keep walking distances short. "It's too far to walk" is perhaps the most common excuse for not walking to a transit station. Destinations can be brought closer to the transit station—by increasing the density of and introducing mixed uses in station areas—but pedestrians remain to be attracted from the existing development within walking distance. This can be accomplished in most cases by extending the reach of the station through the simple elements of sidewalks and crosswalks that are so often missing. Even more effective can be the physical extension of the station itself, bringing it closer to the adjoining development and expanding the comfort and safety of the station.

More variable are other elements, which may be important to some individuals or in some areas, but not in others. For instance, women are more likely to find lighting and surveillance critical to their decision of whether to walk or not, while those visiting an unfamiliar neighborhood can be expected to value station area maps greater than those who use the station frequently. Connections to existing development are more important than encouraging new development at some locations; 87th Station in Chicago and the future station site at Calle Providencia in San Juan are examples. Unmet needs of the surrounding neighborhood and the need for a focus to bring a critical mass of pedestrian activity make new development essential to encouraging walking to the future station at Calle Degeteau in San Juan and Medical Center Station in Chicago.

6.3 The Vicious and Virtuous Circles of Pedestrian Activity

The implementation of the guidelines faces many challenges and opportunities, which are reviewed in the following sections. This research has observed that conditions that work against pedestrian activity have a feedback relationship with one another that, if not reversed, lead to still more miserable conditions, in a vicious circle:

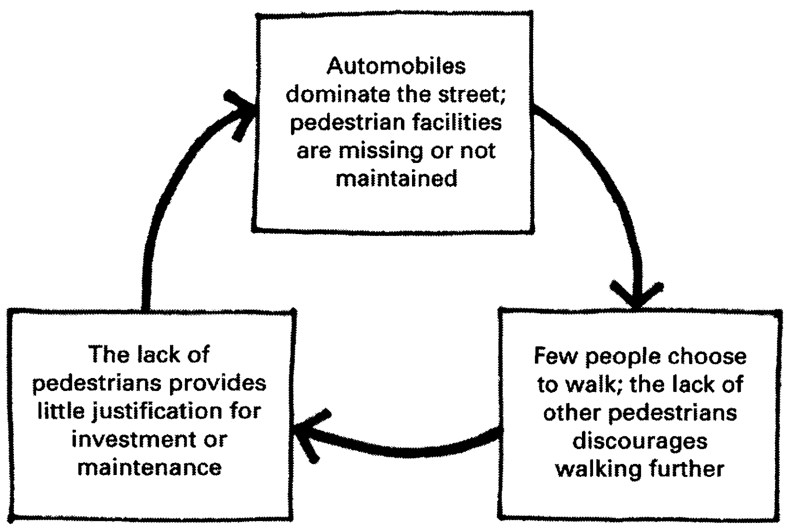

Figure 6.1

The Vicious Circle of Pedestrian Inactivity

- Low densities and the dispersion of origins and destinations in areas where compromised stations are found make walking unattractive. Distances to stations can be far, and a monotony in the intervening space can make them seem still farther. A dominance of automobiles makes crossing streets intimidating and pedestrians must negotiate parking lots and driveways, often without benefit of sidewalks.

- Due to these conditions, few people are walking in the first place, and this lack of pedestrians makes investments in facilities for their benefit seem superfluous. When investments are made, they often find little use due to their context. For instance, a generous sidewalk between a busy arterial and a parking lot may meet pedestrians' need for a direct route, but it leaves them uncomfortably exposed in an environment dominated by cars.

- When few are walking, maintenance is also neglected. A little trash or graffiti can quickly attract more. This detracts from the perception of safety and security, as does the lack of other pedestrians. As a result, still fewer people choose to walk.

- There appears to be little justification for investment and maintenance of pedestrian facilities; automobile traffic is allowed to dominate, and the cycle continues.

However, a feedback relationship also applies to investments that encourage more pedestrian activity, in a virtuous circle:

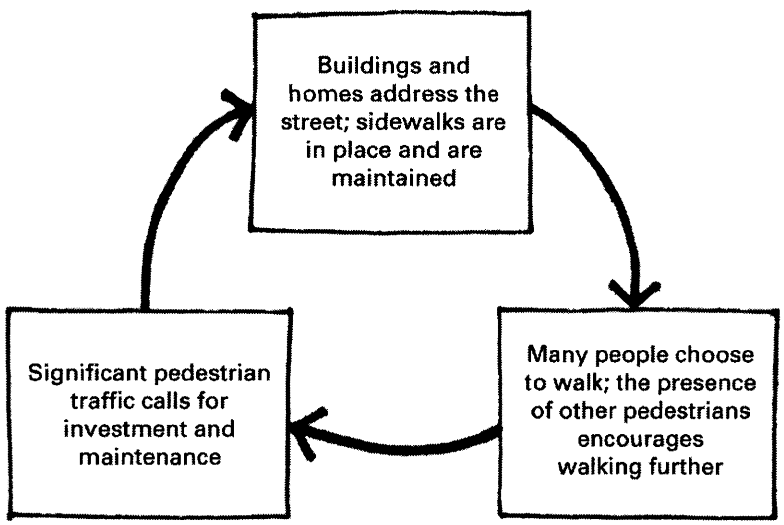

Figure 6.2

The Virtuous Circle of Pedestrian Activity

- Providing sidewalks and crosswalks makes walking a more desirable option. Bringing in additional origins and destinations and orienting them to sidewalks enlivens pedestrian routes to stations.

- More people choose to walk. This makes additional and more involved investments, such as traffic calming or parking lot and driveway reconfigurations, more plausible.

- The presence of pedestrians calls for regular maintenance. Trash and graffiti are quickly removed. Pedestrian routes are perceived as being secure, and even more people choose to walk.

- Significant pedestrian traffic attracts new pedestrian-oriented development, and the cycle continues.

A consideration of the challenges and opportunities associated with encouraging pedestrian activity is informed by an understanding of both the vicious circle of disinvestment and inattention, as well as the virtuous circle of investment in and attention to pedestrian needs. Poor walking conditions are usually the result of a number of factors that have a feedback relationship with one another. Similarly, the strategy that will reverse the downward spiral is different in every case, but will necessarily depend on a synergy of improvements, policy changes, and personal choices working together.

6.4 The Opportunities of Improving Pedestrian Access to Stations

Walking to transit was an integral part of the daily lives of millions of Americans in cities prior to the automobile, and it was desirable and convenient to live and work near stations. While this is true for some people in some parts of urban America today, walking to stations is by no means universally accepted as attractive and convenient. Examples from many cities across the country, however, show that pedestrian-oriented station areas are relevant to the twenty-first century.

Of course, walking to and from the subway is the mainstay of transportation in New York City, but the combination of pedestrian and transit travel is popular in the nation's smaller and newer urban areas as well. The place to be in Denver is somewhere along that city's 16th Street pedestrian mall, with its easy connections to a developing regional rail transit system. "Ground zero" in Portland is Pioneer Square, flanked on both sides by light rail stops. Pedestrian-friendly environments around transit, however, are not limited to traditional downtowns. The concentration of office, retail, and residential uses between Rosslyn and Ballston-MU Metro stations in Arlington County, Virginia, rivals the downtown of any mid-size city. Only a few decades ago this linear corridor of urban activity was largely low-density and suburban in character.

Figure 6.3

16th Street Pedestrian Mall
Denver, Colorado

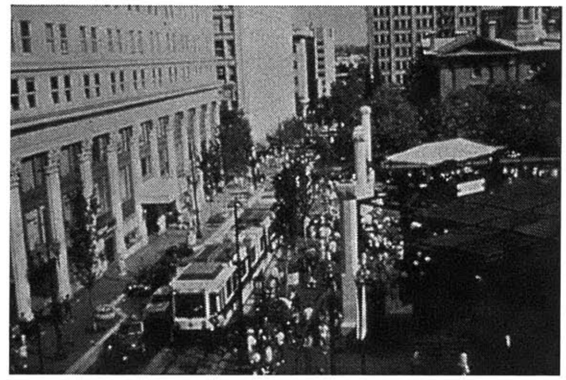

Figure 6.4

Pioneer Square
Portland, Oregon

The metropolitan areas of the United States are becoming increasingly polycentric, and this trend is unlikely to be reversed. While this works against the traditional concept of a radial transit system focused on a downtown, transit is able to maintain its relevance when development of new nodes of urban activity and corridors such as Rosslyn–Ballston in Arlington County form along transit lines. Though continually expanding, the rail transit systems of the U.S. are unlikely to comprehensively serve the entire urban areas in which they are located any time soon. The areas that they do serve, however, offer the promise and choice of lifestyles that are less automobile-dependent. For many, this is very desirable and convenient.

Jane Jacobs wrote that the interaction of pedestrians on city sidewalks is "the spare change of which cities are built." Others have postulated that the essence of a city is its function as the "transfer zone"—the civic realm that people inhabit in between their places of residence and occupation. In an increasingly digital world where work, shopping, and other formerly place-specific activities can occur almost anywhere, the civic realm of a city as a is even more important. Instead of being categorically abandoned for exurbia and rural towns, as technology has made possible, America's large, transit-served cities are actually posting population gains—among them cities like Chicago, which are reversing decades of decline. This can be attributed in part to the desire to be near the civic realm. Unlike the American cities of a century ago, contemporary urban areas include the "transfer zones" of airport runways and freeway interchanges—but these are not the places where people desire to be. They want to be in environments where exchange and dialogue occur between people face-to-face—in the pedestrian-oriented civic realm. Fisher and Radisch attribute the success of Harvard Square Red Line Station in Cambridge, Massachusetts, and Cole and Carl MUNI Station in San Francisco, California, to the fact that "people don't just come to these places to move through them; they come also to linger and be part of the crowd."[1]

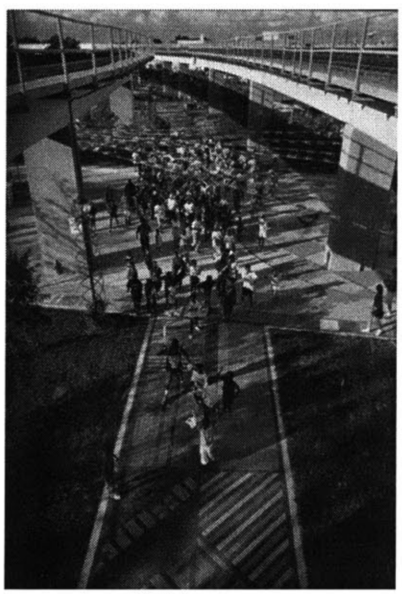

Figure 6.5
9th Street Pedestrian Mall near Overtown/Arena MetroRail Station
Miami, Florida

A "celebration" of pedestrian activity in the civic realm is the essence of a city

Improved pedestrian access to transit stations cultivates the civic realm in whatever context the station may find itself. Some stations simply need better connections to their surroundings to make walking competitive as other modes of access. Many can become neighborhood centers, providing a sense of identity and focus and acting as a catalyst for

[1] Fisher and Radisch 1995, 23

pedestrian and community-oriented shopping and services. Still others can become nodes of regional importance, allowing growth to occur in a compact, transit-oriented context instead of on vast tracts of land on the periphery. In each case, benefits accrue both to the health of urban areas and to transit's vitality.

6.5 The Challenges of Improving Pedestrian Access to Stations

It seems as though a third era in the post-World War II development of urban transportation policy in the United States has arrived. In the 1950s and '60s, urban freeways and highways were seen as the salvation of cities, with disappointing and sometimes destructive results. In the '70s and '80s, with most of the urban highways completed, planners, policymakers, and politicians looked to transit as the answer to urban mobility problems. With the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, transit was given a boost with additional funding. But perhaps more importantly, ISTEA gave legitimacy to the neglected modes of walking and biking by funding such "pedestrian" projects as trails and sidewalks.

Nonetheless, walking generates no revenue, involves no high-tech equipment, nor leads to very many prestige projects. Marcus Wigan remarks that pedestrian travel has "no dedicated major body with revenue streams and information flows to consider investments and regulatory measures."[2] As such, it can be difficult to gather support for pedestrian improvements and facilities. Because "Departments of Pedestrian Transportation" do not exist, and a city, state, or transit authority is fortunate to even have staff dedicated to pedestrian and bicycle issues, it falls upon existing public works departments and transit authorities to meet the needs of pedestrians. Developers and advocacy groups also play an important role. The challenges they face include the following:

[2] Wigan 1994, 4

- *A lack of understanding of pedestrian issues among various entities.*
  Developers, government agencies and even transit authorities themselves may not fully understand what pedestrians' needs are and how to address them, having traditionally focused on vehicles. In recent years, many advocacy groups and transit authorities have published "transit-oriented development guidelines", incorporating many of these issues, to educate both their own staff as well as a wider audience of planners, policymakers, and property owners. The first step toward improvements is often simply raising awareness of both needs and benefits.

- *Limited scope of transit authority property.*
  Transit authorities in the United States are limited with respect to land acquisition and property ownership. Pedestrian routes extend far outside of transit authority property lines and are largely outside of their jurisdiction. Many efforts to improve pedestrian access will require cooperation and negotiation with other entities: state Departments of Transportation, county and municipal departments and agencies, and the owners of private property.

  Despite the limited scope of their property holdings, transit authorities can gain leverage by assisting other jurisdictions in outfitting the facilities under their jurisdiction to be more pedestrian-friendly. The opportunities are especially great when rehabilitation or reconstruction projects are going to be undertaken anyway. Such acts of "good faith" will improve walking conditions for transit riders in the short run, while introducing dialogue between transit authorities and other entities that can lead to greater benefits in the long run.

  Other entities, having discovered the benefits of improved walking conditions in reaching their own goals, can use their own means of leveraging. In advance of the construction of a rail transit system in Texas' capital, the City of Austin has developed a project review process that awards points for transit-oriented features, including those that are important to pedestrian access to future stations. Projects with higher scores are expedited through the review process, giving developers a real incentive to design for pedestrians—which is in their best interest anyway.

- *Issues of maintenance and liability.*
  Multiple entities having jurisdiction over pedestrian routes to stations not only complicates funding and construction activities, but raises the question of who is responsible for maintenance and liability. Sidewalks and pedestrian paths must be cleaned and cleared of snow. Wherever the idea of greater numbers of pedestrians using a particular facility is entertained, fears concerning liability arise. The attitude is often taken that facilities requiring additional maintenance and introducing liability must be avoided at all costs. This unfortunately results in insufficient accommodations for the pedestrian. Interjurisdictional agreements can help resolve these issues, and facilities can be designed to require little maintenance and reduce liability risks.

While the resurgence of rail transit in the United States has occurred without a concomitant attention to the pedestrian environment so vital to it, the idea of walkable communities is beginning to undergo a renaissance of its own. The federal government has earmarked funds, states are hiring staff, and cities are drawing up plans for improved pedestrian facilities. Developers have begun to recognize the public's demand for alternatives to isolated buildings in auto-dominated urban landscapes. And while transit ridership nationwide continues to grow, so does transit's potential to help create these more walkable communities of the future—which will be accomplished in part through improved pedestrian access to transit stations.

6.6 Future Research

This thesis has considered the experiences of many different transit stations and the degree to which walking is an access mode. The numerous factors influencing individual willingness to walk have been explored as well. Both areas are in need of further research, divided below into general research needs followed by those specific to Tren Urbano and CTA rapid transit.

6.6.1 General Research on Pedestrian Access to Stations

Transit authorities undertake ridership surveys that assess mode of access to stations, providing a basis for understanding pedestrian access. Unfortunately, these surveys are typically conducted on an irregular and infrequent basis. On the other hand, research on pedestrian travel or the relationship between transportation and land use provides insights to the special case of walking to stations, but rarely study this specific situation. Research that fills the gap in between is scarce and is needed to provide a more solid basis for future efforts to improve pedestrian access to stations. The following areas are particularly important to informing such efforts:

- An analysis of the various models used to estimate the numbers of boardings that are expected to result from pedestrian access at proposed transit stations compared with actual walk-up boardings once revenue service has begun. This could help point out deficiences in modeling procedures, as well as identify the models that are especially proficient at estimating levels of pedestrian access.

- A study of the factors behind individual modal choice decisions would inform station planning decisions. For instance, the relationship between the cost of parking or the frequency of service on feeder bus routes with the willingness to walk to a station could be examined to determine what combination of investments maximize ridership.

- Market research on amenities that encourage pedestrian travel has been conducted in limited areas and deserves greater attention. It is especially important to understand the differences between stated preferences and what amenities actually do result in greater levels of pedestrian activity.

- As projects specifically intended to encourage pedestrian activity are planned and carried out, "before" and "after" studies would better isolate the relative impact of various interventions and provide a stronger basis for informing similar efforts elsewhere.

- This research has focused on walking as an access mode without an analysis of the interaction of pedestrian facilities with those supporting other modes. Further research could identify both areas of potential conflict as well as areas of mutual benefit.

6.6.2 Research Needs Specific to Tren Urbano

Because Tren Urbano is an entirely new rapid transit system years away from operation, there are many unknowns associated with the project. Research that addresses questions related to pedestrian access in the following areas will assist the ongoing planning and construction of the entire network:

- It is claimed that Puerto Ricans are especially adverse to walking and regard air-conditioned automobiles an absolute necessity. Puerto Rico also has a rich history of civic interaction and promenading. Research could determine how entrenched the proclivity to motorized mobility is in the local culture, and if this is really different from other urban areas of the United States with similar climates. If it is comparable, the experiences of pedestrian access to transit systems in San Diego, Dallas, Miami, and other sunbelt cities have broader application to San Juan. If it is indeed more pronounced, further study of what might motivate Puerto Ricans specifically to walk to transit would be in order.

- Security is of greater concern to residents of Metropolitan San Juan than it is for the average American urban dweller. Pedestrian activity is particularly compromised in Metropolitan San Juan due to gated communities. The ramifications of this on pedestrian travel deserve continued study, as does an analysis of what interventions may be necessary to allay these heightened fears.[3]

- The initial phase of Tren Urbano now under construction includes rather extensive "pedestrian access improvements" around each station within the construction contracts. The intended benefits and usage of these improvements should be quantified and qualified prior to revenue operations for comparison with actual pedestrian activity after service begins. Lessons learned from this comparison will inform the designation and design of "pedestrian access improvements" at future stations.

- An understanding of the institutional arrangements in Metropolitan San Juan is necessary in order to determine which entities are in the best position to advance, plan, and carry out specific improvements that will facilitate pedestrian access to Tren Urbano.

6.6.3 Research Needs Specific to CTA Rapid Transit

Understanding pedestrian access in a large, diverse city such as Chicago has its own specific research concerns:

- Weather extremes in a northern city such as Chicago have a seasonal impact on pedestrian activity. It would be useful to quantify these impacts and research ways that the impacts of snow and cold might be lessened to encourage more walking to stations.

- Many of the same issues that compromise pedestrian access to CTA rapid transit stations also affect its bus stops. A study of how the needs of pedestrians headed to rapid transit, to buses, or transferring between the two, coincide and where they might be different would inform efforts to better meet the needs of all user groups.

[3] Switzky has addressed these needs in contemporary research

- Similarly, bicycle transportation is gaining increased attention and popularity in Chicago. While cyclist and pedestrian needs are often similar, they can also conflict in ways that compromise safety and comfort. Research that seeks to identify how best to accommodate both modes of access is especially germane.

- Station rehabilitation contracts now underway include limited components of modifications that promise to improve pedestrian access. These could be identified and tested for their potential impact using a market research survey. Upon completion of the rehabilitation projects, a follow-up survey would qualify the actual impacts, allowing a comparison that would inform future efforts.

- Though municipal governments control most streets and signals, multiple jurisdictions will be involved in facilitating improved pedestrian access. In the case of expressway median stations, the Illinois Department of Transportation may own bridges that pedestrian routes cross over. Similarly, railroads may have jurisdiction over portions of pedestrian routes to and from stations in their corridors. In any case, it may even be difficult to identify who actually owns parcels and easements, as there may be a long history of properties changing hands, or original documents setting forth the limits of a highway or railroad alignment may be very old or inaccessible. Research uncovering the institutional arrangements around each station will help determine which entities are in the best position to propose, plan, and construct specific improvements for facilitating pedestrian access to CTA rapid transit stations.

6.7 Final Conclusion

Walking to transit is often an uncomfortable and dissatisfying experience. It is desired that this research will inspire transit authorities, other public agencies, and private developers to more adequately address the needs of pedestrians. Additionally, it is also hoped that future research efforts will build upon the findings of this thesis to further support the continued improvement of pedestrian access.

Appendix A
ESTIMATED COSTS OF PEDESTRIAN FACILITIES

The *Portland Pedestrian Master Plan* provides the following unit costs for selected pedestrian facilities:[1]

Item	Cost	Unit
Sidewalk only (1.9 m, curb existing)	$136	per linear m
Sidewalk and new curb (1.9 m)	280	per linear m
Sidewalk with paving bricks (1.9 m)	432	per linear m
Small Retaining Wall (2 m – Modular)	332	per m^2
Large Retaining Wall (4 m – Concrete)	673	per m^2
Curb ramp	3,000	each
Short curb extension	19,000	each
Long curb extension	32,000	each
Long curb extension with sewer work	37,000	each
Install parallel type crosswalk	11	per linear m
Install ladder type crosswalk (3 m wide)	44	per linear m
Brick paving @ crosswalk (3 m wide)	858	per linear m
Small median refuge	920	each
Large median refuge w/ landscape	33,000	each
Add pedestrian head, post and phase to signal	7,020	each
Add pedestrian call button	935	each
New signal	224,400	each
Stairway on grade (1.8 m wide)	834	per linear m

[1] Portland Office of Transportation Engineering and Development 1998, *Portland Pedestrian Master Plan* Appendix F

Appendix B
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Appendix C
PHOTOGRAPH AND ILLUSTRATION CREDITS

All photographs and illustrations are by the author except as indicated below.

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[1] Accessed at http://terraserver.homeadvisor.msn.com
[2] Lyndon 2000
[3] Hock 2000
[4] Hauser 1996

Chapter Five

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[5] Asensio Cerver 2000

Appendix D
COLOPHON

This thesis was produced in Boston and Cambridge, Massachusetts, on an Apple PowerBook G4 computer using Microsoft® Office 2001, Adobe Photoshop® 6.0, Illustrator® 9.0, and Acrobat™ 4.0 software.

Sony Mavica digital cameras, graciously lent by the MIT Department of Urban Studies and Planning (DUSP) and Ginny Siggia, were used to take many of the pictures by the author. The computer resource lab of DUSP provided the Apple Macintosh computers and a slide scanner for processing other images.

Headings are set in 12-point Univers 65.
Text set in 12-point Minion.
Footnotes set in 10-point Minion.
Headers and page numbers set in 10-point Univers 45.
Figure captions set in 10-point Univers 55 Oblique and 45 Oblique.