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The Effects of Environmental Design on the Amount and Type of Bicycling and Walking

National Bicycling And Walking Study

U.S. Department of Transportation
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Foreword

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Table of Contents

Page

Executive Summary 1

Introduction 5

Lessons Learned: Successes and Failures in Downtown Environmental Design 7

- Pedestrian Malls: Destruction and Return of the Street 7
- Skywalks, Tunnels, and Covered Sidewalks 9
- Transit Malls 10
- Street and Sidewalk Improvements 12
- Traffic Calming 14
- Conclusions 16

Overview of Environmental Factors to Encourage Walking and Bicycling 17

- Effective Walking Environments 17
- Effective Bicycling Environments 25

Conclusion: Toward a Comprehensive Approach to Downtown Environmental Design 36

Bibliography 38

Executive Summary

Introduction

Since the 1960s, cities and towns in the United States have been making a wide range of design improvements to make downtown environments more receptive to bicycle and pedestrian use. These improvements have included all types and mixes of auto, transit, walking, and bicycling accommodations. At this point, because of their many years in operation, we can assess how and if these applications actually work, and lessons can be learned for planning future improvements. This report focuses on the effects of environmental design on the amount and type of bicycling and walking in downtown, specifically. Downtowns must serve a complex variety of vehicular and pedestrian functions. The solutions for meeting these requirements reveal broad principles concerning the successful and unsuccessful design of pedestrian- and bicycle-friendly environments. The author's conclusion from research over the past decade, reinforced by information collected for this study, is that a more balanced approach to the design of streets and areas in downtowns that considers how all uses can work together is needed.

Lessons Learned: Successes and Failures in Downtown Environmental Design

Several environmental design approaches have been used in downtowns to foster pedestrian and bicycle activities, with greater or lesser degrees of success.

Pedestrian Malls, constructed in some 200 cities across the United States, were among the earliest approaches, mimicking suburban malls by removing cars and adding amenities. Most didn't work, it was found, because they provided too much space for the pedestrian population, producing a feeling of emptiness and inactivity. Bicycles were generally shut out, for fear of dangerous conflict with pedestrians. Malls now have been "re-streeted" in many cities, re-creating a sense of crowding and vitality by returning to traditional streets and sidewalks.

Two other pedestrian only approaches, *Skywalks* and *Tunnels*, have decreased walking at the street level, allowing domination of these spaces by motor vehicles.

Covered Sidewalks, also devised for pedestrian comfort, appear instead to discourage use. Pedestrians perceive them as confining and unsafe, since the enclosures often attract "undesirables," as well as obscure the view of storefronts.

Transit Malls were constructed to accommodate both transit (usually buses) and pedestrian use. In many cases, buses became dominant, while bicycles were eliminated. It appears that the most successful transit malls include some vehicle traffic plus attractive, well-placed public amenities.

More cities have undertaken a variety of simple *Street and Sidewalk Improvements* than have used constructions such as the malls and skywalks described above. These improvements usually preserve pedestrian, vehicular, and bicycle functions, although sometimes their distribution is modified. For example, sidewalks can be widened or angled parking added on wide streets to reduce traffic speed and increase accessibility. Often, simple cosmetic upgradings, such as the addition of benches, trees, and other pedestrian amenities, will add more life.

Traffic Calming, a term that originated in Europe, refers to a full range of methods that include street and sidewalk improvements to slow down cars, but not necessarily ban them, as they move through commercial areas and neighborhoods. Among them are use of median strips, raised crosswalks, textured pavements, reduced and enforced speed limits, and narrowed traffic lanes. Pedestrians and bicyclists can benefit, because drivers decelerate to speeds that are safer and more compatible to walking and bicycling.

The overall lesson learned from the past 30 years is that environmental design issues must be approached in a multidisciplinary way. Improving streets for pedestrians and bicyclists also entails consideration of transit and motor vehicle traffic. The challenge of the years ahead is to better understand the concept of "mixed-use streets" to serve a variety of functions and activities.

Effective Walking Environments

Among the factors to be considered in creating effective walking environments are:

Balancing Street Space & Uses—a fundamental issue to address, because lively, active public spaces must be encouraged to meet pedestrian needs while at the same time allotting appropriate space for deliveries, parking, bicycles, and vehicular movement. From a pedestrian perspective, it is important to create an appropriate walking space, keeping in mind that there can be too much as well as too little space for walking and for socializing. Space for seating, trees, bus shelters, and other amenities also must be considered, as well as access for special users, such as elderly persons and people with disabilities. In addition, street width, intersection geometry, signal timing, and pedestrian traffic are important factors in designing streets pedestrians can cross freely and safely.

Pedestrian Amenities—Also called street "furniture," amenities, such as seating, bus shelters, trees, telephones, light fixtures, trash receptacles, information kiosks, fountains, and public art, make a street more comfortable to use. Design and location of amenities is as important as their presence, but most important is how effectively they serve people's needs.

Accommodating Management Activities—Downtown management programs are set up to create safe, clean, comfortable, lively places through maintenance, security, events, design improvements, and other activities. Streets and sidewalks must be designed to accommodate these activities and help them work effectively.

Building Base Design—and type of ground floor uses are key components in creating active downtown streets. Blank walls, tinted or reflected glass, internalized functions, (e.g., atriums or malls) discourage walking or window shopping.

Orientation, Signage, and Circulation Systems—Simple, clear, and well-placed information helps people find their way around and encourages walking.

Environmental Design Security—Physical design features of buildings and public areas affect crime rates and perception of crime (e.g., parking lots in secluded areas may invite undesirable activity).

Sense of Place—Design character is important in reflecting local community identity or creating an environment that can be appreciated at a human, street-level scale.

Effective Bicycling Environments

The major factors to consider in facilitating bicycle use in downtowns are:

Bicycle Access to Downtown—This involves such challenges as crowded, narrow streets with turning difficulties, slippery pavement surfaces, storm grates, gutter "trenches," and access barriers (e.g., hazardous bridges and underpasses, and freeways). A simple first step to improving bicycle access is suitability mapping, which indicates which existing streets are fit for bicycle use. The provision of special *bicycle access streets* can also make the trip downtown easier. Particular attention should be given to new opportunities for *freeway* corridors (e.g., by creating parallel paths, grade-separated crossings, improved ramp access and right-of-way bicycle routes); *bridges* (e.g., through retrofits to accommodate bicycle traffic and maintenance to avoid hazards); *underpasses* (e.g., by widening lanes for bicycles, improving lighting and drainage); *railroad tracks* (e.g., by applying rubber matting to the space between tracks to smooth the crossing surface and retrofitting to ensure right-angle crossings); and *rail transit corridors* (e.g., new light rail lines should reserve lateral space for bicycle paths; old abandoned rail corridors can become new pathways).

Improving Bicycling on Downtown Streets—This may involve setting up one-way bicycle lanes on both sides of the street, with or without cars parked at the curb, or providing a wide

outside curb lane on the street, with bicyclists having the option to mix with motor traffic. Bicycles should never be assigned sidewalk space, because of conflicts with pedestrians.

Bicycle Parking—This includes *employee/long-term parking* (i.e., near or at work, protected from adverse weather, accessible at all hours), and *short-term parking* (i.e., stable structures with protective coating and bicycle lock adaptability, highly visible, in many small installations close to building entrances, accessible from bicycling lanes or streets).

Programs to Promote Bicycle Use are important complements to bicycle design factors. They include *educational programs* (to create awareness of bicycling and teach on-bike skills to bicycle commuters); *enforcement programs* (e.g., instituting uniformed police officers on bicycles to keep downtowns safe and developing strategies with local police to enforce the law regarding bicycle-related violations); and *promotional programs* (e.g., "Bike-to-Work Days," "bicycle fairs," employee incentive programs, and bicycle races).

Another factor of importance to bicycle use in downtown areas is improved design of public spaces that creates a lively, comfortable city center, where bicyclists want to be, not only as commuters, but as part of the community.

Toward a Comprehensive Approach to Downtown Environmental Design

The message of this report is that it is essential to understand and provide for all users of a downtown environment while instituting improvements to foster pedestrian and bicycle use. We need to bridge disciplinary differences that treat each use separately and approach the design of streets on a more holistic basis. This will require a broad educational effort directed to transportation professionals, designers, Government officials, business leaders, students (our traffic planners of tomorrow), and the public at large.

Introduction

In the past three decades in the United States, there has been a rapid proliferation of design improvements in downtown areas to make the environment more pedestrian- and bicycle-friendly. Beginning with pedestrian malls in the early 1960s, improvement projects have made use of all types and mixes of auto, transit, walking, and bicycling accommodations—from simple streetscape improvements to elaborate skywalk systems that totally separate vehicles and pedestrians. With this range of improvements constructed and in operation for so many years now, at this point we can assess how they actually work. What impact do these systems have on pedestrians and bicyclists? What factors are important to consider in planning new improvements that build upon lessons learned from past experience?

Project for Public Spaces, Inc. (PPS) is a nonprofit corporation that studies how people use public spaces, and recommends ways to make downtowns more lively, functional, and active. In the past 17 years, PPS has had an opportunity to observe how different design approaches affect bicycling and walking in downtown environments throughout the United States. Many of these applications have been reviewed for this study, along with other domestic and foreign examples to determine what actually has worked, or not worked, to foster pedestrian and bicycle activity.

The authors also have drawn on the bicycle and pedestrian expertise of Dan Burden, the first Pedestrian and Bicycle Coordinator for the State of Florida, and Elizabeth Drake, bicycle and pedestrian planning specialist and author of comprehensive urban and rural bicycle plans in Florida, Tennessee, and Arizona.

This report has a specific focus, but it reveals broad principles for successful design of pedestrian- and bicycle-friendly environments. That focus is on how environmental design affects the amount and type of bicycling and walking in downtown areas. It is not intended to be a complete treatise on what makes an effective downtown, although certainly environmental design issues play an important role in the relative success or failure of any downtown. It does not concentrate on public gathering places, such as parks and plazas. Its major area of concern rather is on pedestrian and bicycle movement areas.

Downtowns are complex environments that must accommodate a variety of vehicle and pedestrian functions. They must accommodate people arriving by car, by bus, and by bicycle, as well as on foot. Businesses have specific requirements in terms of deliveries and parking.

Pedestrians, too, have special needs—and not just for circulation. For pedestrian spaces to be successful, they need to be perceived as safe, comfortable, and active. By our definition, the term "environmental design" encompasses understanding the multitude of functions that take place in public spaces and how to accommodate them.

A conclusion of the author's research over the past decade, reinforced by additional information collected for this study, is that a more flexible approach to the design of streets and public areas in downtowns is needed. The tendency by planners and traffic engineers to isolate and separate vehicular, pedestrian, and bicycle uses tends to create more problems than it solves. Mixed-use streets serve pedestrian functions, accommodate bicyclists as equal users to vehicles, and allow access for private cars, delivery vehicles, and public transit.

This report is structured in two principal sections. The first section is an overview of environmental design improvements and how they have worked over the past three decades. Following this overview, a description is provided of the environmental design factors that need to be considered in promoting effective walking and bicycling in downtowns. A conclusion to the report looks toward the future of environmental design, and the need for new research and education programs so that downtown areas can be made to work more effectively for people—and to avoid the pitfalls of the past.

Lessons Learned: Successes and Failures in Downtown Environmental Design

In looking back over the past 30 years of environmental design in downtowns, much has been tried and much has been learned about how pedestrian and bicycle improvements actually work. There are many positive examples upon which to draw, and there continues to be research and development of new strategies for bicycling and walking.

Unfortunately, some of the lessons have been costly, both in terms of their ultimate negative impacts on the health and vitality of some downtowns as well as in terms of later retrofitting projects to address shortcomings. Still, there are lessons to be learned from the failures as well as the successes. In order to describe how these design strategies have impacted the downtown environment, this section is divided into several different categories, each one dealing with a principal type of downtown improvement project.

Pedestrian Malls: Destruction and Return of the Street

The earliest environmental design improvements in downtowns tended to be the most simplistic. The pedestrian mall—constructed in some 200 cities across the United States—was a way for a downtown to mimic a suburban mall. The assumption was that if cars were removed and lots of space and amenities provided for pedestrians, business would surely flourish.

While there are successful examples of pedestrian malls, most have failed to live up to expectations. The first mall built in the United States in 1959 was in Kalamazoo, Michigan, which even called itself "Mall City." Today, the city is considering turning all or part of the mall back into a street. [11] In Oak Park, Illinois, the mall was actually "re-streeted" in order to reverse the decline of retail sales and increasing vacancy rates—which has, indeed, happened. [3] Riverside, California, is retrofitting its park-like mall so that it has more economic activities such as cafés, markets, and retail kiosks.

Why haven't most pedestrian malls worked? While one argument is that the downtowns in question would have declined whether there was a mall or not, this assertion misses a key point: the environmental design flaws of pedestrian malls actually seem to accelerate decline. Pedestrian malls tend to provide more space than is required for the number of pedestrians that use them, especially in smaller communities. As a result, they are often perceived as empty and

devoid of activity, even when pedestrian volumes are, in fact, relatively healthy. In Poughkeepsie, New York, the authors studied pedestrian behavior on the mall and discovered that very few people actually used the center of the mall: most continued to walk along the face of storefronts, just as they did when there were sidewalks. The difference, of course, is that the center of the street has landscaping and amenities (which were not well-used) as opposed to moving traffic and parking. [26]

That traffic can add to the perception of a street's vitality and improve perceptions of convenience and safety is a concept that was not appreciated when pedestrian malls were first constructed. The experience in Oak Park, where traffic was reinstated while amenities were still provided for pedestrians, has been that the street seems busier, safer, more accessible, and more like a "real" downtown, instead of an isolated oasis. In other words, traffic is a source of functional access, while taking up space that is no longer perceived to be devoid of purpose. Pedestrian activity may not be greater, but it is concentrated in a smaller area, giving a better sense of critical mass.

Another lesson learned from pedestrian malls was that it is possible to provide too many amenities and too much space for them. The centers of many malls are filled with all sorts of gizmos that planners like John Fondersmith in Washington, DC, have compared to a "miniature golf course." [13] Mostly, it has been found that people do not use these amenities. What has been learned is that small public gathering spaces that create a sense of crowding and vitality, actually work better than large, open ones. As William H. Whyte, noted urbanologist, has said, "I have yet to see a pedestrian mall that would not have been better if it had been a block or two shorter." [17] Mr. Whyte's rule of thumb is that it takes 1,000 people per hour to make a downtown street seem active and vital; few pedestrian malls measure up to this standard.

It is interesting to note that the pedestrian malls that have worked have tended to be in college communities. Ithaca, New York, and Boulder, Colorado, both have well-used malls in their downtown areas. The authors studied the mall in Ithaca and discovered that it works much like a park: people come to the Commons to read, relax in the sun, watch children play in the playground, etc. The presence of a university community that has more flexible time and that is more pedestrian- and bicycle-oriented obviously plays a role in making these activities work here. [26]

From a bicycle perspective, pedestrian malls are generally inaccessible. Few malls even allow bicycles on them, because of the real danger of conflict with pedestrians. As a result, bicycles are relegated to outside streets, rather than being encouraged to be part of a main commercial area of a city.

Cities where pedestrian malls have been "re-streeted" often have had positive results. In Oak Park, vacancies decreased and retail sales increased (24 percent in the first year), in part because of an aggressive marketing and coordination program that follows the management structure of suburban malls. [5] Combined with this, some businesses report large sales increases that they attribute to the new visibility they have to people driving past, plus the higher level of

comfort people have in using the downtown area in the evening. In Poughkeepsie, one block of the mall was reopened to traffic, and vacancy rates declined from 31 percent to 10.7 percent. [32]

In Santa Monica, California, there has been an interesting twist on the pedestrian mall retrofit. The Third Street Mall, which was widely viewed as unsuccessful and unattractive, was rebuilt as the Third Street Promenade, with a street. The rebuilding of the street afforded an opportunity to attract movie theaters that have, in turn, transformed the street into an exciting entertainment district with restaurants, bars, bookstores, etc. The project has been so successful that the city decided to ban traffic! [19] This project is a reminder that the whole idea of urban lifestyle, cafés markets, and outdoor promenading has become more attractive in the past 30 years, and these activities are now highly valued.

From a design perspective, the Third Street Promenade still looks like a street even though traffic is banned. Walt Disney realized the power of this approach in Disneyland's "Main Street" where there is a street, but no traffic except for pedestrians and trolleys. The street concentrates activity on sidewalks (although people still walk in the center), and amenities are typical to those that would be found in streets with traffic. The amount of pedestrian traffic seems appropriate to the amount of sidewalk space devoted to it, and the fact that pedestrian traffic has to spill over into the street only shows how successful it is. Plus, there is future flexibility to allow traffic if it ever becomes necessary.

Skywalks, Tunnels, and Covered Sidewalks

A variation on the pedestrian-only approach is the skywalk, conceived in Minneapolis as a way for people to move around the downtown without going outside in cold weather. This approach has been copied in other cities with similar climates (such as Rochester, New York) as well as those with mild climates, like Los Angeles. Other downtown areas have chosen to go underground, such as downtown Houston and Montreal. Above or below ground, these approaches have a negative impact on street life in a downtown area.

Skywalks decisively change the way a downtown functions. Because people now circulate at a different level, retail space becomes more valuable one floor up. In Minneapolis, the higher rent shops are on the second level; the street level is dominated by service businesses. As pedestrians and shoppers move up, the street level becomes abandoned. Traffic engineers take the opportunity to fully develop vehicular or bus efficiency, accelerating the deterioration of pedestrian use. In Charlotte, North Carolina, street-level shops disappeared when a skywalk-connected mall was built, and the main shopping street became little more than a bus terminal. Now a transit mall, this street is more attractive, but not more lively, than it once was.

Another variation of the skywalk is the enclosed sidewalk. This approach is, as we know it now, simplistic, but, unfortunately, many examples were actually built. In Ottawa, Canada, for example, the Rideau Mall was constructed as a transit mall and sidewalks (and adjacent bus shelters) completely enclosed in glass. The results have been dismal; the sidewalks seemed

confining and unsafe, and became dominated by "undesirables." It was impossible to see from one side of the street to the other, and storefronts were completely obscured from outside the covered area. A 1987 report on the Rideau Mall stated, "Severe financial difficulties are being faced by merchants and property owners facing the street. The quality of the urban environment is unsatisfactory and is incompatible with a street located close to the heart of the nation's capital. There is public frustration that a major east-west street is closed to regular traffic." [12]

Originally heated, the heat on Rideau Mall was soon turned off to save energy and to reduce undesirable use. Recently, the city has voted to completely remove the covered sidewalks and restore the street, at a cost of many millions of dollars.

Transit Malls

Minneapolis constructed the first transit mall in the United States in 1967, and it was soon hailed as a national example of urban public space. Considered a bold and innovative move in its day, Nicollet Mall successfully generated almost $50 million in downtown development within 3 years. The mall was unique because it included not just amenities for pedestrians, but a serpentine roadway that allowed city buses to circulate along the street. Nicollet, still a popular destination at the time, became a combination bus terminal and shopping street.

Nicollet Mall was copied in many other cities across the United States: Philadelphia, Portland, Oregon, Denver, Chicago, and Boston to name the most well-known. Their construction was encouraged by Federal funding from the Urban Mass Transportation Administration (now called Federal Transit Administration). As with pedestrian malls, the limitations of the approach became more apparent as the years went on. The basic problem was buses. Noisy, big, and smelly, buses are not often compatible with pedestrian strolling, sitting, and window shopping. Bus waiting areas become the major amenity focus on a transit mall. As a result, the transit functions of the street seem to dominate at the expense of other activities.

In nearly every city where they have been built, transit malls are being rethought, or have been altered from their original concept. In Boston's Downtown Crossing, buses have been removed and the street is pedestrian-only during the day. In Chicago, a total redesign of the State Street Mall has been proposed to return to a mixed-traffic street, without trucks. Sidewalks were actually widened beyond what was needed and, as a result, were underused. Under the new proposal, sidewalks will be narrowed, although they will still contain extensive amenities. The idea is that buses, mixed with traffic, are less dominant than buses alone.

Even Minneapolis has rebuilt the Nicollet Mall, although it has not changed its essential mix of functions. The problem with the mall was part physical, since it was in a state of disrepair as elements gradually wore out, and part functional. Users in surveys complained about bus fumes and lack of bicycle access. Nicollet was no longer a major shopping street. The development it spurred ended up removing activity on the street, as a second-level skywalk

system was developed that essentially elevated retail activity above the street. The system, which does not connect directly to Nicollet Mall, now connects some 35 blocks. [17]

The redesign of Nicollet Mall did not address its functional problems. While the Nicollet Mall includes plans by 1994 for smaller, electric-powered vehicles, which should reduce the bus fume problems, bicycle access has not been improved. Plans to connect the Mall to the skywalks, which might have improved access, were scrapped. Kate Christianson, a Minneapolis writer on design issues, wrote that the while some changes have made the mall "friendlier," it also "seems spiritless.... The overall passivity of the redesign is all the more painful because the Mall originally swirled in excitement." [8]

On a positive note for transit malls, Portland, Oregon's bus mall, while transit-oriented, has actually always allowed one lane of vehicle traffic on it. The mall is attractively laid out with very well-designed bus waiting areas and simple street amenities (e.g., benches, information kiosks, and plantings) along it, as well as well-placed public art. The placement and design of amenities is often poorly understood by designers; in the case of Portland, however, amenities are usable and placed according to function. Because of the design of these street amenities, the mix of traffic, and the excellent maintenance and street management program, the Mall is the most successful of all those constructed.

Learning from the experience in other cities, Rochester, New York, sought to create a mixed-use traffic street, with appropriate priority for buses. Originally conceived as a pure transit mall, the Main Street project was rethought to allow more diverse use and access. The street was reduced from six lanes to four, with the curb lanes given over to buses only. Parking and delivery were removed (the latter remains a problem), while sidewalks were widened to provide more space for pedestrian amenities and bus waiting facilities. While the street is well-used by pedestrians, it must compete with a skywalk system. In addition, retail conditions have declined with the closing of a major department store, so it is difficult to assess the impact of the approach taken.

The issue of electric buses, as planned for Nicollet Mall, is an important one, and many cities are looking to retrofit their pedestrian malls with such buses or trolley systems. Denver's Sixteenth Street Mall was the first large-scale demonstration of the use of free, electric bus shuttles, which connect passengers to two bus terminals at either end of the mall. As a transportation corridor, the mall achieves a much better balance between buses and people than if standard diesel buses were used. It is difficult to determine the impact of the electric bus, however, because the mall is not as effective a public space as it could be. Amenities, for example, are located in a center median, rather than along the sidewalks, and the overall design of the street is rather formal and cold. For these and other reasons related to the regional retail market, the Sixteenth Street Mall still suffers from retail decline and a major program is underway to revitalize this aspect of the mall.

In Sacramento, California, a trolley system has been installed in the center of the former pedestrian mall; Memphis is planning a similar retrofit to the Mid-America Mall. While this can

be seen as an improvement, and trolleys are more pedestrian-friendly than buses, they do not usually operate with great frequency, so that the center of the street still seems devoid of activity. Rail systems, because of their tracks, are also incompatible with bicycle use.

In Portland, Oregon, a light-rail transit system has exceeded all projections in terms of passenger use. This system, which is separate from but intersects with Portland's bus mall, has been very effectively integrated into the downtown area. The Banfield system, as it is called, is a 15-mile route that connects the downtown area to the suburbs, and, once it reaches downtown, becomes a part of the downtown street network. One of the strengths of the system is that the modal mix in which it operates changes according to the block. In general, it runs on mixed-traffic streets, but still discourages a great amount of private vehicle use. Where mixed traffic does occur, space for vehicles is limited, and on certain streets shared space is allocated to pedestrians only.

Sidewalks have been widened slightly to accommodate small waiting areas. The trains, while long, are quiet and relatively unobtrusive—but clearly operate in street space, not a pedestrian mall. Public spaces in downtown, including Pioneer Courthouse Square, are clearly enlivened by the system's presence, not dominated by it. It is an example where transit, pedestrian, and vehicle uses are balanced.

Street and Sidewalk Improvements

In terms of actual numbers, more cities have undertaken simple improvements to streets and sidewalks than have constructed the more elaborate improvements previously described here. Many of these improvements do not change the width of sidewalks or the mix of vehicles. They are simply cosmetic upgradings and usually include the addition of benches, trees, and other amenities for pedestrians. Other projects change the distribution of space by widening sidewalks, or providing "neckdowns" or "bulges" that shorten pedestrian crossings in key locations, such as intersections. Projects may or may not change parking or vehicle patterns.

Often, a simple approach to streetscape improvement is all that is necessary. If sidewalk widths are adequate, if there are places for people to gather in public spaces, with accessible parking and traffic speeds under control, then simple cosmetic improvements can make a difference. However, it is the author's experience that rarely are all these factors "in place" without requiring some modification. For example, in San Bernardino, California, new trees, benches, bus shelters, and other amenities were located on sidewalks too narrow, with the result that some sidewalk areas have less than 3 feet clear walking space. Meanwhile, the streets have five lanes for traffic, which is far in excess of needed capacity. Fortunately, city administrators realized the limitations of their approach and designed amenities to be relocatable when funds were available to widen sidewalks. In addition, the city is experimenting with diagonal parking, removed in the 1950s, to slow down traffic and make the downtown area more pedestrian friendly.

Pedestrian malls and transit malls seek to deal with the issue of parking and traffic by eliminating it. As we have seen, the results have been mixed. In street and sidewalk improvements, all functions are kept, although sometimes modified. The street usually continues to accommodate through traffic, parking, buses, bicycles, and deliveries—and the sidewalks carry pedestrians and provide the amenities necessary to make the downtown area seem active and lively.

There are many examples of street and sidewalk improvements that have only slightly altered traffic and parking patterns—but to great impact. At Shubert Square in downtown New Haven, Connecticut, sidewalks were widened 4 feet (from 12 to 16 feet) by narrowing vehicle lanes, and neckdowns were provided at intersections by eliminating one parking space. The net result may not sound like much, but the extra space has made a major difference in the street for pedestrians, although some question remains on how bicyclists are accommodated. Amenities including large trees could be placed on the sidewalk without reducing pedestrian walking space. A café occupies one of the neckdowns. Merchants have attractive flower boxes and outdoor displays.

When space for amenities is limited, as it is in New Haven, it becomes even more important to design and place these amenities with regard to their ultimate use and function. The original design concept for Shubert Square was a very rigid and arbitrary placement of elements without regard to their impact. Trees blocked storefronts; there was too much immovable street furniture, and not enough space for cafés and flexible uses. Fortunately, the city and the developer in the area rethought the approach and simplified the design. As a result, there is lively pedestrian activity, and amenities are well-used.

In Orlando, Florida, Orange Avenue in downtown was narrowed by one lane in order to widen sidewalks. Although bicycles are not accommodated at all, pedestrian activity has dramatically increased in the downtown since the streetscape improvements were constructed. In New York City, on Avenue of the Americas, street space was reclaimed for pedestrians in Greenwich Village. Irregular intersections once paved over for cars were reconfigured, creating a series of triangular plaza/parks along the avenue.

Also in Orlando, around the entertainment complex known as Church Street Station, the city takes a "managed street" approach to pedestrians and vehicles. During the day, when pedestrian activity is lighter, the street—curbed and paved with brick—remains open to traffic. Because the street is brick and passes though a plaza area and over railroad tracks, cars drive quite slowly (an estimated 15 mph or less) and mix, in fact, with pedestrians crossing and jaywalking freely. At night, when there are more people in the area, the street is closed to traffic and used exclusively for pedestrian uses. Often, portable displays, vending, tables, and chairs are moved into the street space to further animate it.

Traffic Calming

Traffic calming is a term that has emerged in Europe to describe a full range of methods to slow cars, but not necessarily ban them, as they move through commercial areas and residential neighborhoods. The benefit for pedestrians and bicyclists is that cars now drive at speeds that are safer and more compatible to walking and bicycling. There is, in fact, a kind of equilibrium among all of the uses of a street, so no one mode can dominate at the expense of another.

It is interesting to note that traffic calming exists in certain downtown areas as a natural outcome of design initiatives to accommodate sizable special populations. College communities, for example, have a high percentage of bicycle riders and pedestrians with environments shaped to meet their needs, such as in Ames, Iowa; Gainesville, Florida; Eugene, Oregon; and Davis, California.

The concept of traffic calming sometimes contradicts traditional traffic engineering goals to move traffic as efficiently and quickly as possible. Many traffic calming methods, including most environmental design improvements, entail slowing vehicles down or altering their routes in some way. Such approaches to facilitating traffic movement as removal of parking or widening traffic lanes are actually the opposite of certain traffic-calming techniques. However, more and more interest is being generated in traffic-calming strategies in residential and commercial districts.

Obviously, traffic calming can be a component in a variety of downtown environmental design improvements. However, physical reconstruction and changes to sidewalks are not necessarily essential for calming traffic. In some cases, traffic calming can alter the use of street space by incorporating changes as simple as provision of diagonal parking on wide streets to reduce speed and increase accessibility, as is being done in San Bernardino, California, and Corpus Christi, Texas. Other changes that have the same kinds of impacts include use of median strips, raised crosswalks to slow traffic, reduced and enforced speed limits, textured street pavements (as in Church Street in Orlando, Florida, in downtown Seattle, Washington, and Portland, Oregon), and narrowed traffic lanes.

One example of a main street where traffic is calmed is Pondfield Road in Bronxville, New York. The street has always had diagonal parking, which slows but doesn't stop vehicles as they pass through downtown. Sidewalks are slightly narrow (about 10 feet), but shaded by mature trees that arch over the street. It is easy to cross the street, and the whole environment is conducive to shopping and strolling, while still allowing vehicle access. One limitation, however, is that no bicycles are allowed: "too dangerous," say local town officials.

In Hindersonville, Alabama, which has a senior citizen population that comprises almost one-fourth of the population, Main Street was a former state highway. When the highway was rerouted to adjacent streets, planners reduced the width of Main Street, increased the width of sidewalks, and placed alternating diagonal and parallel parking on the street. This gives the street

a serpentine design that is attractive and also controls traffic speed. Since instituting this traffic-calming, slowing-down-vehicles approach, Hindersonville has lowered its retail vacancies from fourteen to one. [16]

Cities have also addressed specific issues related to traffic direction and speed, as well as to conflicts between pedestrians crossing the street and vehicles making turns. Portland, Oregon, has one-way paired streets, which reduce turning movements and conflicts at intersections; because its transit priority areas share and narrow down available street space for vehicles, traffic is generally slower. In Washington, DC, one-way streets have been returned to two-way, and all turns at some intersections have been eliminated as a way to reduce traffic speed and conflicts with pedestrians. In Victoria, British Columbia, midblock crossings (which have no turning movements) have been established at alleyways that have also been enhanced for new retail uses. Finally, Florida has established regulations regarding curb cuts into parking lots and garages that restrict their number and establish design guidelines for those that do exist.

Most of the best examples of traffic calming, however, are not in the United States. Originally introduced in the Netherlands and Germany, traffic calming is also now being replicated in such countries as Denmark, Sweden, and the United Kingdom. Many of the improvements being initiated there are low in cost (unlike a pedestrian or transit mall), can be installed on a trial or experimental basis, and are easy to change and modify.

Traffic-calming techniques fall into two general groups: one based on traffic management strategies, the other on physical design. Traffic management strategies include issuance of center-city passes, truck restrictions, signalization systems, transportation system management, parking management, traffic reduction ordinances, car and fuel taxation, and speed limits.

Traffic-calming design techniques create physical impediments to speeding, such as road undulations, humps, rumble strips, or speed tables (crosswalks raised to sidewalk level). Some make use of strong vertical elements to create pinch points or gateways. Since a wide and straight street with perfect visibility is most conducive to speeding, some traffic-calming approaches reverse this effect through the creation of psycho-perceptive illusions of street width by altering the driver's sight lines. The interruption of sight lines is often accomplished by changing the road's direction through incorporation of "S" bends or implementation of staggered parking or neckdowns. Other direction controls include roundabouts, offset intersections, diagonal diverters and channels. Interestingly, it is possible to change pavement patterns through change of materials or color so that the roadway looks narrower than it is. Such a combination of gateway and pattern pavement is used throughout the Netherlands to signalize the beginning of a built up or commercial area or the start of a transition area where pedestrian volume increases. The area can be supplemented by central medians, sometimes asymmetrically curved to further narrowing roadway, and by footway signs.

In 1981, Germany set up six traffic-calming demonstration projects in villages, towns, and cities of varying density. The initial reports showed that with a reduction of speed from 37 km/h [23 mph] to 20 km/h [12 mph], traffic volume remained constant, but there was a 60 percent

decrease in injuries, and a 43 percent to 53 percent reduction in fatalities. Air pollution decreased 10 to 50 percent. The German Auto Club, skeptical of the official results, did its own research that showed broad acceptance after initial opposition by the motorists. Interviews of residents and motorists in the traffic-calmed areas showed that the percentage of motorists who considered a 30 km/h [18 mph] speed limit acceptable grew from 27 percent before implementation to 67 percent after implementation, while the percentage of receptive residents grew from 30 percent to 75 percent. [7]

It is important to note that these speeds are also highly compatible for bicycles, without relegating them to special lanes: they can simply share the street space with vehicles. Bicycle lanes can have utility—especially in allowing access to downtown on major streets. Attempts to restrict bicycling to certain downtown streets, however, tend to discourage bicycle use. Bicyclists need access to all destinations in a downtown area and should not be excluded. In Gainesville, Florida, an extensive network of bicycle lanes was built, and bicycling now accounts for 10 percent of all commuter traffic. Recreational bike routes are also popular and, as they pass through downtown areas, help stimulate new business, as has been shown in Providence, Rhode Island, and Pinellas County, Florida.

Conclusions

The overall lesson learned from the past 30 years is that environmental design issues are not simple and must be approached in a multidisciplinary way. In other words, improving streets for walkers and bicyclists is not just a pedestrian issue, a traffic issue, or a transit issue—all must be considered together. It is important to balance all of the functions on a street so that they all work together. Projects that have tended to stress one function over another, whether it be pedestrian, transit, bicycle, or vehicle traffic, have generally not lived up to expectations. On the other hand, projects having considered that streets must serve all users have had much higher success.

The challenge of the years ahead is to better understand the concept of "mixed use streets": streets that are able to serve a variety of functions and activities, that can change over time, and that do not attempt to put forth simple-minded solutions to complex situations. Mixed use is both a design approach as well as a challenge for the continuing management of a public space. At the foundation of mixed-use streets is the need to calm traffic: this makes a street more attractive to pedestrians and bicyclists.

This next section describes more specifically from a mixed-use perspective the factors essential to creating effective walking and bicycling environments in a downtown area.

Overview of Environmental Factors to Encourage Walking and Bicycling

Given the experience over the past several decades with a variety of design approaches intended to facilitate pedestrian and bicycling activities, it is possible to derive the key environmental design factors that lead to effective walking and bicycling environments in downtown areas. It is important to emphasize that there are enhancing factors other than design and related issues that are important to consider, although not discussed in detail below, especially management of public spaces. The document, *Managing Downtown Public Spaces* describes in detail how various management strategies—security, maintenance, event programming, markets, vending, etc.—are essential to well-used downtown public areas. [25]

This section is divided into two parts: one dealing with walking, the other with bicycling. While there is obvious overlap between the two, it is important to distinguish design factors important to each.

Effective Walking Environments

How can pedestrian improvements be designed to meet people's needs more effectively? This section discusses this question, first from the point of view of use of downtown streets, balancing the needs of people in cars, buses, on bicycles, and on foot, as well as effective placement of amenities. Additional design factors are then discussed, including accommodation of special events and activities, the design of buildings to support effective walking environments, signage, orientation, design character, safety, and access for special users.

Balancing Street Space & Uses

The principal issue that must be addressed in the design of a commercial street is how to allocate its space: how much to give pedestrians and how much to vehicles. "Balancing" space is a concept that is used to describe allotting space to meet pedestrian needs—encouraging a lively, active public space, while at the same time maintaining appropriate space for deliveries, parking, bicycles, and vehicular movement.

Pedestrian Walking and Amenity Space. Determining how wide pedestrian walking space should be is more complex than it initially appears. Sidewalks are divided into imaginary lanes:

next to the store windows is a lane about 2 to 3 feet wide, which is "viewing space" used by window shoppers; at the curb, people generally allow 1 1/2 feet between themselves and any trees, signposts, traffic signs, etc., thus creating a second lane; in between is the "walking space." There is a minimum desirable width for this walking space, 8 feet, or the amount of space necessary for two pairs of pedestrians to pass each other comfortably. There is no such rule of thumb, however, for the *maximum* width of a walking space; but having too *much* space is just as undesirable as having too little. Too much space makes a sidewalk seem "empty," because people are distributed over too large an area. This occurs in many pedestrian malls, as noted above, particularly during times of day when the number of users is low.

City sidewalks are not just thoroughfares for pedestrians; they function as social places where people gather to talk or meet friends and to watch others pass by. While a sidewalk may be wide enough to accommodate pedestrian movement, it may not be wide enough to simultaneously accommodate seating, trees, bus shelters, and other appropriate amenities that support social activities. If a sidewalk is not wide enough for both walking space and amenities, it should be expanded or modified to provide those amenities.

In designing pedestrian areas, it is also mandatory to plan for the needs of special users. Often the requirements to provide access for people in wheelchairs, the blind, or the elderly are important, but somehow "separate" from the needs of "normal" people. In reality, providing for the needs of special users, and most people have a disability at some point in their lifetime, if only temporary, usually results in better spaces for all people. There is a great deal of literature about requirements for meeting the needs of special users with regard to technical design decisions such as widths of spaces, level changes, pavement textures, and so on. The important issue again is the integration of the needs of all users, not their segregation.

Pedestrian Crossings. Allowing people to cross the street as freely as possible is important, because there are usually businesses and destinations on both sides of any commercial street. Often the width of the street, the geometry of the intersection, and the timing of the traffic signals are designed only for the needs of vehicles, not pedestrians. For example, it is not unusual for a crosswalk to be too narrow for the number of people using it, especially since the pedestrian flow consists of two platoons of pedestrians who meet in the middle of the street. The distance of crossings from each other also needs to be considered, in terms of the types of adjacent uses and average volumes of pedestrians.

Another consideration is the radius of the intersection corner. Traffic engineers often prefer wide radii that make it easier for vehicles to turn. However, the larger the radius, the more inconvenient and dangerous it becomes for pedestrians. Greater ease of turning leads to speedier vehicle movement and less time for pedestrians to establish right-of-way in crossing the street. Bicyclists may also have problems with large corner radii, because fast-turning vehicles can cut across the paths of the slower moving bicycles.

There are many changes that can be made to facilitate pedestrian crossing. Crosswalks can be widened and corner radii reduced to 1–5 feet, with a maximum of 25 feet. The actual

width of a street also can be reduced through widening sidewalks, by installing a center median, or through "neckdowns." "Neckdowns" (also called "bulges," "bulbs," or "chokers") jut out from sidewalks into streets in extensions that line up with parking lanes. These provide pedestrians shorter passage to cross and safe waiting places that are often enhanced by amenities, while maintaining the same traffic lanes and boundaries. Traffic management strategies, such as restricted turning movements and reduced traffic speeds, can clearly reinforce these design changes.

Vehicle Space. To balance the needs of pedestrians with those of vehicles on a street, it is necessary to understand how vehicles use a street for through movement, parking, and deliveries, and how any changes made for pedestrians might affect these activities.

Eliminating on-street parking, rerouting, or restricting traffic to certain hours, calming traffic speeds to encourage through traffic to go elsewhere, or giving priority access to buses are all examples of ways that street space can be made available for pedestrian or bicycle use. Ultimately, the kinds of changes that can actually be made to a street are limited by the width of the street and by other physical constraints that may exist. Even if vehicular uses cannot be modified, it is still possible to make improvements by widening sidewalks at only the most congested locations or at intersections.

On narrow streets, permanent design changes are particularly difficult to provide because space is limited. In these instances, it may be possible to use a more flexible management approach to the street by allowing total pedestrian use during the times of day when numbers demand it (through temporary street closings, for example) and permitting required vehicular use at other times. However, a flexible street management approach is appropriate only if the density of pedestrians is such that the street will not lose vitality and seem empty when vehicles are no longer present. This way to balance street space therefore becomes less and less desirable the wider a street is.

Pedestrian Amenities

Pedestrian amenities are also called street "furniture," since they make a street more pleasant and comfortable to use. There are all kinds of amenities. Seating (on benches or planter ledges), bus shelters, trees, telephones, light fixtures, trash receptacles, and information kiosks are the most common, but clocks, fountains, sculpture, drinking fountains, banners, and flags are frequently provided as well. The vending of food and other items can also help to stimulate activity on the street, whether as part of store displays, in movable pushcarts, or in permanent stands. Therefore, vending can be considered an amenity as well.

Although amenities can make a street more comfortable and active, their mere presence will not ensure that they will be well used. Careful attention to the design and location is important. For example, seating is frequently unused or used only by derelicts and others whom people view as " undesirables." Bus shelters often afford little protection from the sun, rain, or

wind and provide few places for people to sit or lean while waiting. Vending kiosks may go unrented if they are situated too far away from areas of activity.

Amenities are all too often treated as "objets d'art" on a street. A trash receptacle is placed every 50 feet, a bench every 100, and trees marching in rows 40 feet apart. This regimentation of amenities bears no relationship to the needs of any specific location. It is necessary to decide what will most effectively serve the people who use the street. This decision is particularly important when funds are limited and only a few amenities may be provided.

Location is a critical factor that affects how an amenity is used. Although it seems obvious that a bus shelter should be located at a bus stop, it is not commonly recognized that other amenities have similar location requirements.

The location of seating, its relationship to adjacent building uses, has a great deal to do with the way it is used. Research by the authors has shown that people like to sit and watch other people go by, and that most people prefer to sit right where the most people are and the most action is, rather than to seek out some secluded spot. The "action" includes the various people going by, but it also includes their diverse activities such as socializing, window shopping, and eating. Seating tends to be used more frequently when people are outside major destination points, such as outside the main door of a department store. People can rest for a minute before going on with whatever else they have to do. Seating is also frequently used outside takeout food places like ice cream stores or delicatessens. In general, the more that seating is placed in such locations, the more likely it is to be enjoyed and less likely it is to be abused.

One of the most common mistakes made when positioning amenities is the assumption that the street will never change. Streets do evolve, and the design and placement of certain amenities should be capable of responding to such changes. Of course, some amenities (like trees and bus shelters) must be permanent. But others, particularly seating and vending, do not have to be cast in concrete. With public space management, a street can be viewed as a "stage" on which various activities take place. Café tables can be moved in and out. Vendors can set up at locations where the most people are, and may even move during the course of the day. Merchants can place attractive displays outside their stores. Benches and chairs can be moved around.

Even if an amenity is properly located, it still may be difficult or uncomfortable for people to use. Many problems with improvements to commercial streets can be traced to simple lack of understanding about how an amenity actually functions. If the seat of a bench is the wrong height above the ground, the wrong shape to fit the human contour, or too cold or too hot to sit on, people simply will not use it as much as one that is better designed. In an evaluation of benches in New York City, the benches that were found to be most comfortable were constructed of wood with backs and contoured seats. (For a detailed discussion of street amenities, see [28].)

Accommodating Management Activities

Shopping center managers have long understood how to create safe, clean, comfortable, and lively places that attract people. Public spaces in shopping centers are constantly maintained, have private security guards, offer the opportunity to buy a snack while strolling, and provide entertainment, promotions, and often elaborate seating, fountains, and other amenities.

In the past decade, cities and towns of all sizes across the United States have replicated the management approach of shopping centers and applied them to a downtown situation. The concept of downtown management is relatively simple. The private sector, working in cooperation with city governments, can jointly fund and coordinate programs to improve downtown maintenance and security, sponsor events and activities, and undertake a wide variety of design and nondesign programs to activate and enhance a downtown. Downtown management programs are, in the author's view, essential components of a downtown design improvement plan—as it allows a city to keep a high level of maintenance, to program activities, and to make design and management changes as necessary to keep a design working effectively.

With a management program in place, it is possible to have a different type of design for downtown streets and public spaces. It is possible, for example, to use more flexible seating, such as movable chairs, because there is a management structure in place to take care of them. Vending programs can be sponsored as a way to activate a street. In Boston, the Downtown Crossing Association sponsors a vending program of nearly 100 different pushcart vendors. The vendor fees generate a major portion of the Association's annual budget.

Streets and public spaces must also be designed to accommodate management activities. Spaces for events must be clearly identified, and such features as electrical outlets for sound systems, seating for the audience, and location and orientation of the performer planned for at the outset. The same is true for activities such as vending and markets. Locations should be considered and the functional needs of vendors accommodated. In Portland, Oregon, for example, the city designates the location of vendors on the Portland Mall, regulates the design appearance of carts, and oversees their operation. Other cities across the country have initiated similar regulations to encourage vending in such a manner as it contributes to the positive vitality of a downtown area.

Farmer's markets and other types of outdoor markets have had a resurgence in recent years, and are now important programs in many downtown areas. From a design perspective, the markets need to allow both access for trucks and sales areas for the vendors, while creating a dense and exciting environment for shoppers. Often this can take place in very "undesigned" kinds of spaces, such as parking lots or even in the middle of a street. In Santa Monica, California, the Saturday market is located in a street that is simply closed to traffic for a morning; in Portland, Oregon, it is located under a highway overpass; in New York City, the Union Square Market is located in street space around the park.

A managed public space is more flexible, both in its use and its design, than one that is not managed. It requires careful attention to structuring space and setting up support systems so that the manager can program events and activities easily. The benefits are obvious, however, in terms of the ability to have a downtown environment that can change and evolve to meet community needs.

Building Base Design

A key component in creating an active downtown street is the design of building bases and the type of ground floor uses. It is at the street level that a building must come to terms with the city that surrounds it. All too often, the ground floors of buildings are designed in such a way as to virtually eliminate activity. Blank walls, tinted or reflected glass, and a generally harsh environment do little to encourage walking and window shopping in a downtown. By internalizing functions, in atriums or malls, or by creating dull and empty plazas around buildings, walking is discouraged in a subtle but effective manner.

There is not a city in the United States that does not have an example of a building that is poorly designed at its base, and usually there are many more than just one building. Some of the worst examples are in Sun Belt cities, such as Houston, Texas; Miami, Florida; Los Angeles, California; Dallas, Texas; and Phoenix, Arizona. These are cities where there could be a great deal more walking activity, because the climate is comfortable much of the year.

There are, however, many cities that have initiated ordinances and design review procedures that regulate the design of buildings at their bases. New York City has particularly stringent regulations regarding blank walls and "penetrability" of street level buildings. San Francisco, California, and Portland, Oregon, have established similar restrictions.

Existing downtown buildings present different problems. Many older downtown buildings have facades that, once attractive and welcoming, have fallen into disrepair. The National Main Street Center of the National Trust for Historic Preservation has established programs across the country dealing with improved management of "Main Streets," with particular focus on restoration and rehabilitation of historic buildings. The Main Street model was based on the work of Norman Mintz in Corning, New York, where, as the first Main Street Manager, he worked with property owners to renovate scores of buildings in the downtown. In such rehabilitation, particular design attention is paid to window displays, type and location of signage, and visibility into stores. All these design improvements make walking down Main Street a more interesting experience.

Orientation, Signage, and Circulation Systems

One of the common complaints people have of downtown is that it is confusing to find their way around. This is not a complaint so much of the people who are regular users, but rather those who only come downtown occasionally or who are tourists or visitors.

Despite these problems, only a few downtown areas have actually implemented signage systems that direct people to major destinations. Cities such as Rochester, New York; Santa Monica, California, and Orlando, Florida, have developed color-coded signs that lead people to the well-known downtown attractions and to parking facilities. These signage systems work because they are simple, do not try to overwhelm people with information, and are of a color and design character quite different from normal street or traffic signage.

Once people get downtown, they are faced with the problem of how to get around. In smaller downtown areas, it is possible to walk to most destinations. In larger cities, downtown areas are often composed of many subdistricts. In Orlando, for example, the city has designated five districts as part of its downtown plan, each with its own identity and special needs. The problem is that it is too far to walk between many of these districts. Office workers, especially, tend not to walk more than 1,000 feet or about three blocks away from their offices. This raises the need for internal circulating transit systems, buses and trolley cars, that allow people to go quickly from one part of downtown to another. Orlando is currently planning such a system.

Environmental Design Security

Physical design features of buildings and of the public areas throughout downtown locations affect crime rates and the perception of crime. For example, a parking lot located in a secluded area may be a staging area for crime, or the rear of a park may be a hangout for undesirables because there are no surrounding commercial establishments to generate other activity. Many strategies can be used to reduce the opportunities for crime that are inherent in the structure of the buildings and the layout of the public spaces downtown as well as to reduce perceptions of danger.

To be effective, a program for reducing overall crime rates and making people feel safe downtown must address environmental design issues comprehensively. Unsafe or inactive areas of the downtown district where problems occur (or where people perceive that problems occur) should be redesigned to increase activity and visibility. Actions may require minimal changes such as trimming a hedge or shrubbery that surrounds a park to allow for greater visibility.

The trend toward designing interior-oriented buildings, with few or no commercial uses fronting on the street and very tight control of access, may be counterproductive to the long-term security of downtown areas. Such design brings most activity inside the building, and makes the surrounding public spaces of downtown areas more conducive to undesirable behavior.

Another type of security strategy involves programming public spaces. One of the most effective ways to remove "undesirables," and the associated security concerns, is to increase the proportion of "desirables." There are many different ways to achieve this. One common approach, activity programming, involves establishing an event or function that will attract a large crowd of people. For example, noontime classical music or jazz concerts in a downtown park can attract office workers and displace loitering, drug dealing, or the presence of "undesirables."

One of the best examples of successful activity programming and environmental design security is Exxon Park in New York City. In 1978, this vest-pocket park was not actively used by downtown workers and had become a center for drug dealing. A redesign and management plan for the park, prepared by the authors, added new seating, a café, and vendors, and increased the visibility of the park from the street, while also instituting a regular program of events and entertainment. The use of the park has increased threefold, with more elderly and women users, and the drug dealing has been completely eliminated. [25]

"Sense of Place"

Beyond the many functional issues that have been described so far is the issue of design character: how the design of public spaces creates an environment that can be appreciated at a human scale—closeup and at slow speeds. Another related issue is the idea of "placemaking," such as public art that reflects special community interests and ideals.

The character of most designs in downtown public areas has changed dramatically in the past decade. Prior to the 1980s, designs were often "contemporary" in character. The pedestrian malls of the 1960s, for example, are clearly from that period in terms of the style and appearance of the materials and amenities used in them. Beyond their style, such designs often lacked the rich details that enhance the experience of the person on foot.

Beginning in the 1980s, a more concerted effort was used to reflect traditional local design and enrich the details of streetscapes. The design of the Banfield light rail transit system in Portland, Oregon, is a case in point. The design, which has been positively received by the community, is unobtrusive. It does not, as its architect states, shout: "Look at Me. I was Designed." The forms of light fixtures, transit shelters, and other amenities were drawn from bridges and small public buildings built in the 1930s, and are detailed to complement the historic districts through which the transit passes. The paving materials include cobblestones salvaged from old Portland streets. Lighting poles are designed to carry lights and overhead electrification for the trains, and are uncluttered in appearance. The result is a system that becomes more than just a way for the commuter to come downtown: it has established a community "sense of place" that is unique to Portland. [35]

Public art and special features also contribute to a "sense of place," as well as people's use and enjoyment of public spaces. Artists are now much more involved in street and public space projects where they actually create public amenities rather than standalone sculptures. For example, in Seattle, Washington, an artist designed manhole covers, light fixtures, and benches, in what has become a kind of "arts walk." Many spaces are activated with temporary rather than permanent installations. In New York City, the Public Art Fund sponsors temporary exhibitions in many sites around the city.

As with other design factors, "sense of place" is a concept that needs to be addressed and have its purpose defined in the early stages of a design process. For example, is the purpose of the art to reflect community values or history? Is it to build a base of expanding local arts

activity? Or will it serve a specific functional need, such as providing a place to sit, or lighting a sidewalk at night?

Effective Bicycling Environments

As with pedestrians, there are many design factors that facilitate the use of a downtown area for bicyclists. These factors include: (1) bicycle access to downtown areas; (2) improving bicycling on downtown streets; (3) bicycle parking; and (4) programs to promote bicycle use, visibility, ease of orientation, and a "share the road" attitude. Each of these is important. In addition, there must be a broad, long-term view of improved city center design that includes activities and facilities for the entire community, and considers the needs of bicyclists in concert with all users.

In modern U.S. downtown areas, bicycles are not generally part of the traditional traffic mix. Motorists, pedestrians, and transit drivers generally respect historically established "turf" and behavior patterns. However, except in major cities such as New York, Washington, DC, and San Francisco, where bicycle messengers are found in large numbers, downtown cyclists are rare. Motorists begrudge them any space, and the hazards of mixing bicycle and pedestrian traffic are clear. Within the public right-of-way, motor vehicles, public transit, and pedestrians compete for limited space. When bicyclists are added to the mix, the "balancing act" becomes much more complex.

Bicyclists wishing to travel on downtown streets often face considerable challenges. Many downtown areas are historic city centers, with narrow streets that are crowded with buses, delivery trucks, autos, pedestrians, and parked and double-parked vehicles. One-way streets create turning movement difficulties for bicyclists. The roadways themselves are often booby-trapped with hazards such as parallel-slat storm drain grates, slippery pavement textures, and debris.

"Bicycle-friendly" downtown streets and facilities offer potential benefits in terms of improving air quality, traffic flows, parking, health, and transportation choices. In downtown areas, where space is limited, destinations concentrated, desk-bound office workers numerous, and where traffic moves slowly and is highly regulated, the importance of encouraging increased bicycle use is obvious. The guidelines and examples that follow describe how cities can take significant steps to make downtown areas work for bicyclists.

Access for Bicycles to Downtown Areas

Just getting *to* a downtown area can be difficult. Many downtown areas were built at major transportation hubs—rivers, railway termini, and highway junctions. Freeways and other limited-access roadways often are the major linkages between outlying residential areas and the central city. Provision is seldom is made for bicycle travel on or parallel to these major feeders. Bicyclists must wind their way through congested surface streets, busy industrial areas, and inner-

city districts where security may be a concern. They must cross bridges, freeway access ramps, railways, and underpasses that all represent significant potential hazards.

A very simple first step toward improving bicycle access is preparation of a map that shows bicyclists which existing streets are most "suitable" for bicycle use. Factors generally considered in establishing levels of suitability include: traffic volumes, presence of signals, traffic speed, street width, pavement condition, presence of hazards (e.g., bridge expansion joints, slippery surfaces, parallel-slat storm grates, gutter "trenches"), and barriers (e.g., bridges and underpasses unfit for, and sometimes banned from, bicycle use). Suitability maps often provide information on bicycle parking locations, bikes-on-buses, topography, bicycle facilities, and key attractions. Using these maps, bicyclists should be able to plot the most suitable route to a downtown area from any direction. These maps should be carefully researched, involving local commuter cyclists in the process. All routes should be field-checked *by bicycle*. Some of the best examples of downtown-supported suitability maps are in Portland, Oregon, Miami, Florida, Missoula, Montana, and Gainesville, Florida.

Bicycle Access Streets

Provision of streets that provide access for bicycles and which feed into a downtown area is highly desirable. Specific access should be provided from multiple directions. In some cities, such as Phoenix, Arizona, one-way streets west of the heavily-trafficked Central Avenue were striped with bicycle lanes more than 12 years ago, and link downtown areas to major residential districts. East of Central, a bicycle path parallels a new freeway feeding into downtown areas.

If lanes cannot be provided, "BIKE ROUTE" signs coupled with a wide (14.5 to 16 feet) curb lane, and parking restrictions, are a good alternative. The signs alert motorists to the potential presence of bicyclists on the street, and the wide curb lane allows motorists to pass bicyclists comfortably, without crossing outside the curb lane. Missoula, Montana, a college town of about 60,000 people, has made a series of streets and bridges user-friendly for bicycle travel into the downtown area. Although there are few actual marked bicycle lanes, all streets have been designated on the town's bicycle suitability map according to their overall widths and ability to support bicycle movement, and two vehicle bridges, which formerly were condemned, now have been converted for bicycle use. Eugene, Oregon is another city placing high emphasis on getting bicycles conveniently into the downtown area: it has built three bicycle bridges.

Freeways

Many states do not allow bicycles on freeways, especially in central-city areas. Generally, freeways can present significant barriers to bicycle travel. The pedestrian bridges that go over them at intervals are not suitable for bicycle use without dismounting: their steep grades, tight turning radii on ramps, inadequate width, and the presence of closely-spaced bollards (short posts) or other barriers are generally well below AASHTO standards for bicycles. [1] At- or below-grade freeways cut off local streets frequently used by bicyclists.

Additional efforts should be made to provide bicycle access paralleling freeways in urban areas, allowing bicycle commuters to travel the same direct route as motorists. These routes can use a combination of paths within the freeway right-of-way and local streets. Special provision should be made for routes that cross freeway access ramps and major streets. Grade-separated crossings allow safe, uninterrupted bicycle travel and can be designed and placed to allow continuous bicycle travel along key streets linking downtown locations to residential areas and other destinations. Where grade separation is not possible, special signage, signal activation, and crossing markings are needed.

Some cities, such as Orlando, Florida, are looking at adding bicycle paths to current freeway rights-of-way. Boston, Massachusetts' Central Artery is being considered for relocation underground, and if that occurs, a new park above ground will have walking and bicycling corridors. Detroit, Michigan, has an active bicycle path on one major freeway. This path runs from the outlying suburbs past many suburban commercial centers, and is an effective support link to the popular Greenfield Village.

Bridges

Travel into downtown areas in many United States cities involves crossing bridges that present formidable barriers to bicycling. Bridges are generally designed to minimum standards necessary for accommodating motor travel. Sometimes, there is a single pedestrian sidewalk separated from travel lanes by a railing or curb. Metal expansion joints, drawbridge sections, and other bridge design elements can trap or deflect bicycle wheels and also can be slippery. Bridges can accumulate debris that forces bicyclists into unsafe lane locations. They also are subject to general surface deterioration, which can cause bicyclists to crash. High-span bridges are prone to high winds. Traffic on bridges is generally heavy and moves within very narrow lanes, obstructing views of bicyclists riding to the right. These problems should not be viewed as reasons for excluding bicycle travel, but instead as impetus for adapting engineering principles to build and maintain bridges for full access by all modes of travel.

Retrofitting bridges to accommodate bicycle travel is not easy. Some bridges have been enlarged for bicycling and walking by removing an old sidewalk, cantilevering additional width on the deck, and replacing the old, heavy concrete with lighter-weight concrete. In most instances, however, a pedestrian sidewalk is adapted by addition of a 4.5-foot railing designed per AASHTO standards. [1] Since pedestrian traffic across many bridges is light, mixed bicycle/pedestrian traffic may be feasible, but two other considerations may present problems. First, pavement width is not generally adequate to meet AASHTO standards for multiuse facilities, i.e., with adequate shoulders and clearances to vertical obstructions or dropoffs. [1] Light poles, utility boxes, structural bridge elements, and other obstructions may intrude on the path, narrowing usable width. Second, access to and from the two-way bicycle/pedestrian path must be carefully designed. The transition from one-way, on-street lanes to a two-way bridge path can lead to confusing and hazardous turning movements as bicyclists cross and re-cross the motor traffic flow.

Where possible, one-way bicycle travel facilities across bridges are strongly recommended, so that bicycles move *with* the flow of motor traffic. Lanes within the roadway or bicycle/pedestrian sidepaths designed to meet AASHTO standards should be provided. All bridges designed in recent years are required to have a 10-foot (6-foot minimum on long bridges) shoulder, which also acts as a temporary breakdown lane. These lanes effectively accommodate bicycling, and should be swept on a regular basis to clear debris.

Progressive bicycling cities, such as Portland, Oregon, and Seattle, Washington, have built bicycles into the initial design stages of very long bridges: in Portland, crossing the Columbia River and, in Seattle, on the new floating I-90 bridge over Lake Washington, which connects the suburbs with the downtown area. The Portland crossing is handled as a bidirectional system in the center median area, with special ramps in and out of the Interstate (I-5), while the lengthy crossing of Lake Washington is handled as a 12-foot wide bidirectional path on the north side of the bridge.

Other cities, such as Eugene, Oregon, provide access to downtown areas by use of special bicycle/pedestrian bridges. Ferry or water taxi systems, such as those in Seattle and New York City, can link one downtown area to another or connect a series of neighborhoods to a downtown location. Such strategies may reduce otherwise heavy demands for bridge traffic, keeping an older bridge in place for decades with adequate capacity for bicycles and pedestrians.

Underpasses

In some cities, access to the downtown area involves travel through underpasses built to accommodate railroad crossings or surface-level freeways. Unless properly designed or retrofitted, these underpasses can present barriers to bicyclists. Typical problems are similar to those found on bridges: narrow lane width, minimum-standard sidewalks, or no sidewalks at all, exhaust fumes, poor lighting, hazardous drainage grates, drainage problems, poor maintenance, and heavy traffic. Security in darkly-lit tunnels is also a problem. With a bit of imagination, shorter tunnels can be kept full of light in the initial design, or with a bit of retrofit, longer ones can be lit, by creating open air shafts through a median within the ground-level roadway.

Often, underpasses are old and difficult to retrofit. If retrofit to AASHTO standards is not possible, consideration should be given to providing a separate bicycle/pedestrian underpass or a suitable at-grade crossing.

At a construction cost of $60 to $90 million, Fort Lauderdale, Florida, is designing a new highway tunnel underneath the intercoastal waterway into its downtown area. One alternative being considered is to create a fully separate bicycle path in the roadway tunnel, through use of a Jersey barrier. Another proposed alternative is a separate tunnel for bicycle access. Another option is to provide a bicycle path up to either side of the 100-foot wide intercoastal canal, and build an elevated skyway over the canal. Although all of these solutions are expensive, Fort Lauderdale recognizes that bicycles must be provided access into and out of downtown areas.

Rail Corridors

To encourage increased bicycle use, new light rail lines should reserve lateral space for bicycle pathways. Operating rail lines often can be converted to a joint-use corridor, as in Seattle, Washington, where an active rail line right-of-way has a fence-style barrier separating the rail and bicycle activities. Abandoned rail corridors make excellent pathways, sometimes directly into the center of town. Seattle is also making use of utility easements to form its bicycle access system.

While rail corridors offer many potential benefits, the rail tracks themselves are potential hazards. Where key bicycle access streets into downtown areas cross at-grade railroad tracks, the crossing area should be retrofitted so that: bicycles cross at right angles to the tracks; additional pavement is provided for the turning radius necessary for bikes to avoid swinging into traffic to execute a right-angle crossing; rubber matting or similar material is used to fill in the space between tracks and provide a reasonably level crossing surface; adequate warning signs and markings are provided; and all abandoned side rail spurs are eliminated.

Bicycling on Downtown Streets

Bicyclists on downtown streets find themselves in competition for limited public space with pedestrians and motor vehicles of every kind imaginable. Striping bicycle lanes in accordance with AASHTO standards is certainly a desirable way of allocating a place in traffic for bicycles, but this is seldom feasible. Bicycle lanes are often opposed by merchants who want on-street parking in front of their shops or offices, since adequate width for both parking and bike lanes (12 to 13 feet *minimum* on both sides of the street) can seldom be provided. Compromises are possible, especially where delivery or pickup parking can be inset into wide sidewalk areas in designated locations, and as part of an overall streetscape design with the purpose of reducing auto traffic speeds.

Parking restrictions are often implemented when downtown bicycle lanes are striped. The result is that an approximately 8-foot-wide parking space is divided up between bicycles (4 or 5 feet) and motor vehicles (3 or 4 feet added to travel lanes) so that traffic moves faster. This can have negative consequences for bicyclists and pedestrians alike. High-turnover, on-street parking in front of shops and offices is often considered to be a contributor to active downtown streets. This may create a lively street environment, but it represents an inherent danger to bicyclists using the roadway. The hard reality of the "balancing act" becomes apparent in this situation.

Integrating bicycles on a downtown street is further complicated by potential conflicts with moving vehicles. Since there are few travel corridors available for use by bicycles in downtown areas, other than roadways, it is essential that there be a network of corridors where motorized speeds are held to a moderate level (i.e., 20 to 25 mph). Two-way bicycle lanes or paths generally should not be designated within or adjoining a downtown street. A few examples of semisuccessful two-way bicycle lanes exist, such as in Madison, Wisconsin, and Eugene, Oregon.

If bicycle lanes are striped along one-way streets, the bicyclists should travel only in the same direction as motor traffic. Parking should be prohibited near intersections and driveways, so that approaching motorists have adequate distance to scan for bicyclists. Consideration should be given to a full ban of "right turn on red," and left turns should be highly restricted, especially from higher-speed roadways.

Bicyclists and pedestrians do not mix, unless there are only a few of them on a facility. Bicycle facilities should not be designated in, or adjoining, pedestrian sidewalks even if separated, striped, colored or signed as "bikes only." Unless a continuous stream of aggressive bicyclists is present, the problems of keeping pedestrians off the path are considerable. The problems are exacerbated in downtown areas where large numbers of pedestrians crowd sidewalks and other pathways. If there is an accessible alternative path available, people will use it, even if it *does* say use is restricted. Law enforcement personnel do not generally enforce "exclusive use" restrictions and accidents can result.

Regardless of where bicycle traffic is accommodated within the roadway, maintenance is a critical factor in encouraging bicycle use. With attention focused on heavy traffic, frequent intersections, jaywalking pedestrians, transit vehicles, and double-parked delivery trucks, the bicyclist has enough to worry about without adding broken pavement, parallel-slat storm drain grates, uneven gutters, standing water, and debris to the list. Frequent and high-quality maintenance of downtown streets, such as clearing of debris, repair of pavement, and drainage problems, should be an integral part of any downtown bicycle transportation proposal.

Drainage grate inlets and utility covers pose potential hazards. Utility covers can be very slippery when wet, and the pavement around them is often deteriorated or built-up, resulting in a discontinuous travelway that can deflect a bicycle wheel. The bicyclists' travelway should be routed to avoid them if at all possible. Parallel-slat grates should be replaced with hydraulically-efficient, bicycle-safe grates, or, as a minimum, be corrected on a temporary basis with metal slats welded perpendicular to the grate openings. An even better solution is to use curb inlet designs to get the drainage grate fully out of the roadway.

Motorists should be alerted to the presence of bicycles. Some cities have a special W-11-1 diamond-shaped bicycle sign with a "share the road" marker underneath. This way, motorists are alerted and told that bicyclists belong, and bicyclists are understood to have full access and belong on all roadways of their choosing. Under such a treatment, there is no designation of a bicycle facility, just a greatly increased awareness that bicyclists belong. Ten Florida cities now use the "bicycles sharing roadway" signs, and Clearwater, Cocoa Beach, Gainesville, Largo, Melbourne, and St. Petersburg are among those that have reported noticeably improved sharing characteristics.

ALTERNATIVE SCENARIOS FOR INTEGRATING BICYCLING ON DOWNTOWN STREETS

One-way bicycle lanes painted on both sides of the street; parallel parking remains at curb

Advantages:

- Parking remains to provide easy access to shops and offices.
- Bicyclists have clearly defined lane in roadway.
- Parking creates buffer between pedestrians and motor traffic.

Disadvantages:

- Necessary minimum width (8-10-foot parking lane, 5-foot bike lane, *both* sides of street) is generally not available on narrow downtown streets.
- Bicycle lanes are generally not wide enough to allow two bikes to pass without riding into the adjoining motor lane; however, in most downtown commuting situations, (short blocks, low traffic speeds, signalized intersections) this may be acceptable.
- A greater hazard is represented by location of parking next to the bicycle lane. Motorists not used to bicyclists on the roadway can cause accidents by suddenly opening car doors, parking across the lane or pulling out into traffic without scanning for oncoming bicycle traffic.

One-way bicycle lanes painted on both sides of the street; parking removed or restricted to off-peak hours and/or one side parking

Advantages:

- Provides good visibility for bicycle traffic.
- Gives bicyclists easily identified on-street space and relatively hazard-free travelway.
- May result in improved traffic operations since additional motor lane widths may be provided.

Disadvantages:

- Removes direct parking/motorist access to adjoining shops and offices.
- Removes perceived "buffer" between pedestrians and motor traffic.
- May increase motorist speeds.

Wide outside curb lane provided on street; bicycles generally ride to the right but mix with motor traffic, depending on travel speeds and conditions

Advantages:

- Requires less additional roadway width than bicycle lane striping (approximately two to four feet added to motor lanes, each direction).
- Allows bicyclists flexibility in use of roadway.
- Parking can remain.

Disadvantages:

- Bicycle "turf" not defined; bicyclists' visibility and rights to the roadway not as obvious as when a special facility is present.
- Hazard from parked cars is the same as noted for on-street lanes with adjacent parking.
- May generate higher overall traffic speeds, due to reduced side friction, and less stacking of exiting/entering vehicles.

Bicycle Parking

Surveys of commuter bicyclists show provision of secure and weather-proof bicycle parking to be a major concern. Bicycles may represent a substantial investment as well as a dependable mode of transportation. Some commuters can store their bicycles right in their offices, but many are not so fortunate. Space is sometimes provided in a corner of parking garages or in a special storage room. Once at work, few bicyclists have lockers or showers available. They must carry or store changes of clothing and find places to "freshen up" before getting down to work.

If lunchtime trips extend beyond walking distance, then bicycles must be retrieved for an hour or so. Since most central city restaurants and shops do not offer bicycle parking facilities, bicycles may be chained to trees, benches, or fence railings while their owners have lunch or go shopping. These bicycles can impede pedestrian traffic and are highly visible targets for thieves.

Three basic types of bicycle parking are needed: employee/long-term parking, short-term parking, and parking associated with transit facilities.

Employee/Long-Term Parking

Parking for employees should be dictated as a ratio of required motor vehicle parking spaces. It should be protected from adverse weather conditions and conveniently located relative to the place of work, preferably in the same building. Bicycle parking must be secure: preferably in a locked enclosure or in lockers visible to a security guard or parking attendant, with access monitored by the attendant. To enable users to feel comfortable accessing bicycles in off-hours (the parking area should be accessible at all hours), the parking areas should be well patrolled and well lit.

Bicycle parking should be accessible from driveways or ramps designed to accommodate bicycle travel. If a locked enclosure is not provided, the bicycle rack should be designed so that bicyclists can lock the frame and rear wheel (as a minimum) to a stable, upright structure. This structure should be coated to prevent damage to the bicycle's finish, and designed so that the bicycle cannot twist or be knocked over. It should be sized to allow use of "U" style locks.

Short-Term Parking

Provision for short-term parking needs should be required for all downtown businesses and at all public buildings (City Hall, library, police department, arts centers, etc.). Parking should be located in both public parking garages (with the same characteristics as "long-term parking," above) and at the perimeter of public spaces. Short-term bicycle parking should be located in highly visible areas, but where it will not obstruct pedestrian traffic, and planned in many small installations close to building entrances, rather than in a few large groups. In order to provide access directly from bicycle lanes or key bicycling streets, a curb cutout or pullout area should be provided so bicyclists do not have to dismount in the street. Realizing that many

people will *ride* to and from the parking area (regardless of regulations to the contrary), potential conflicts with pedestrian traffic should be minimized. The bicycle rack should be designed as previously described for long-term parking.

Parking at Transit Facilities

Transit facility parking should be highly secure and similar in many respects to long-term parking, as described previously. If at all possible, the bicycles should be parked in an attendant-controlled area. Since commuters leave their bicycles at one end of their trip or the other for an extended period, it is strongly recommended that enclosed parking be provided. This can take the form of an enclosed shelter with an attendant to check the bicycles in and out, or of bicycle lockers. As part of its proposed new light rail (OSCAR) project, Orlando, Florida, is providing showers and lockers at a major transit stop inside a transit-served parking garage. For years, Washington, DC, has had secure bicycle parking for its metro commuters, because most of the city's more popular metro stations have bicycle lockers.

Some problems with bicycle lockers have been reported. Although they offer good security, it is difficult to limit their use to storage of bicycles. If lockers are used, they should be located where an attendant can monitor their use. Use should be limited to a specified term (e.g., 24 hours), with all lockers being cleared accordingly. Lockers can be set up for free use (bring your own lock), for coin operation, or for operation using cards or tokens distributed via a permit system. A required key deposit with a quarterly maintenance fee of $10.00 to $15.00 can be an effective management tool to keep track of when a locker is being used regularly. In general, if a good management program is implemented, lockers can be an effective parking solution.

Parking Ordinances

Many cities have incorporated bicycle parking requirements into zoning ordinance provisions. These ordinances require provision of bicycle parking as a percentage of required motor vehicle parking spaces or in a ratio to building square-footage or number of employees. Palo Alto, California, Tempe, Arizona, and Gainesville and Brevard Counties in Florida are good working examples of places where ordinances and planning/zoning codes have been effectively used. Some of these allow a reduction in required automobile parking if convenient bicycle parking is provided, with even further reductions possible in automobile parking with provision of showers and lockers.

Programs to Promote Bicycle Use

Even the best-planned bicycle lane is a poor investment if no one uses it, if motorists ignore it, or if bicyclists using it ride irresponsibly. Adopting and aggressively implementing a *comprehensive* program of bicycle improvements is strongly recommended. Facility-building is not enough.

Bicycle programs should include a full range of promotional, educational, and enforcement-oriented elements. Among these are:

Educational Programs

Educational efforts should be targeted to specific road users, such as motorists, bicyclists, bicycle messengers, pedestrians, transit drivers and riders, the disabled, and professional drivers, as well as to special populations, such as ethnic groups (bi-lingual materials) or seasonal retirees and visitors. They should include on-bicycle skill training for bicycle commuters (like the "Effective Cycling" program) that teaches traffic survival skills and responsible riding, plus basic bicycle maintenance. They also should be structured to work through major employers to conduct training programs and educational campaigns.

Enforcement Programs

It is important to work with local police departments to develop realistic strategies for enforcement of the law concerning bicycle-related violations by motorists and bicyclists alike. Bicycle law enforcement is typically given low priority in the context of urban crimes. It should be given greater emphasis, particularly as motorists and bicyclists go through the "start-up" period of adjusting to each other's presence on the roadway. "Bike cops," i.e., uniformed police officers on specially-equipped bicycles, should be instituted downtown to fight crime. Many cities have found these patrols to be highly effective at crime fighting as well as having strong public relations benefits.

Promotional Programs

From "Bike-to-Work" days to "bicycle fairs," to bicycle races and promotional events and work with employers to establish incentive programs, promotional efforts can increase visibility for bicycling and overall levels of interest.

A Long-Term View: Bicycles and Downtown Environmental Design

Bicycles can play a strong role as a viable transportation mode in downtown areas. They take up little space on the road or in parking areas, are inexpensive to operate, and have often proven to be faster than motor vehicles in downtown traffic. For a relatively modest investment in street improvements, facility design, parking, and programs, most cities can offer bicycling as a viable alternative downtown transportation mode.

An effective city center is one that creates and maintains a rich system of alternatives to the single-passenger automobile. Bicycles are one more means to help keep cars parked all day. To this end, a pleasant downtown setting, office loaner bicycles, bicycle rentals at transit stations, good public transit, and intermodal linkages where bicycles are fully accommodated should be given the greatest possible consideration.

Bicycling works best within: (1) an improved physical environment with a focus on access and barrier elimination; (2) higher densities in and surrounding the downtown area; and (3) proximity to the key employment, Government, cultural and retail activities. Bicycling should be seen as more than exercise. Bicycle use for transportation into downtown areas should be encouraged not only for work trips, but also to allow people to go to an outdoor theater, socialize in a central plaza, shop, join in street activities and festivals, and in general be part of the action and life of the city. A successful downtown area includes families coming in by bicycle on weekends or evenings, and children bicycling down its streets on trips they make by themselves.

Design decisions affecting downtown areas must be balanced by an understanding of what not only all bicyclists, but all users, need. To help designers of downtown environments become familiar with bicycling needs, it would be beneficial to them to actively consult with experienced bicycle professionals. It would be especially advantageous for urban designers in metropolitan areas to have full-time bicycle/pedestrian program specialists available to them. Designing to accommodate bicycles in downtown areas presents many challenges, including potential conflicts with pedestrians and vehicles. With the help of bicycle/pedestrian experts, downtown areas can be reoriented to more fully meet people's needs and establish a balance between the modal choices of all users.

Conclusion: Toward a Comprehensive Approach to Downtown Environmental Design

In this last decade of the 20th century, it has become increasingly apparent that driving must be reduced to minimize pollution, save energy, and rejuvenate community life. Despite this growing awareness, we are still largely shaping our environment to accommodate the car. Clearly, we need to focus more on design alternatives that provide opportunities for bicycling and walking, and that help reduce automobile dependency. However, while less motor vehicle activity is desirable, this does not mean that it should be eliminated entirely, any more than all pedestrian or bicycle or transit use should be banned. The lessons of the past generally show that favoring one special use on the street meets with limited success.

The basic message of this report is that it is essential to understand and provide for all the users of a downtown environment, while instituting improvements that will foster pedestrian and bicycle use. More emphasis needs to be placed on thinking of human-scale improvements in the design of streets, sidewalks, and public spaces—where amenities and activities create an environment conducive to walking and interaction that builds a sense of community.

The people who make decisions about downtown pedestrian and bicycle improvements—architects, landscape architects, traffic engineers, city planners, State transportation officials, transit operators, local business and community leaders—tend to deal in a kind of disciplinary vacuum. Designers are knowledgeable about creating visually attractive spaces, but may not be aware of the functional aspects of street furniture. Traffic engineers make decisions from the point of view of moving vehicles, all too often without considering basic assumptions about the effects of traffic speed or without considering impacts on pedestrians. Transit operators look for efficiency of buses and trolleys but may ignore their relationship to life on the street. Local business people want to maximize the access and visibility of their shops but may not understand how creating effective pedestrian areas can increase business.

We need to bridge these disciplinary differences and approach the design of streets on a more holistic basis. This involves both education and a fundamental rethinking of existing standards. More effort is needed to research and document what has already been achieved in cities, both in the United States and abroad, to establish new models, and to build a broad constituency through information dissemination and education. More attention must be given to creating streets that truly accommodate all people.

In this light, it would be beneficial to explore expansion or revision of traditional traffic engineering principles, currently geared to expediting traffic, to address more walking and bicycling considerations. It also would be useful for these principles to include refinements specifically tailored to meet the individual transportation needs of differing environments, such as town centers or urban neighborhoods.

In addition, more transportation professionals can be educated to recognize the needs of pedestrians and bicyclists in normal professional highway planning, design, and operations procedures. To that end, information on traffic calming and successful environmental design approaches must be made more widely available to traffic engineers, with details on methodology and examples.

Materials also must be developed for college-level transportation courses to teach the engineers of tomorrow a new transportation philosophy, and design strategies that focus on the mobility needs of all users. Whether for students or for practicing professionals, information can be in written and visual formats, from books and reports to slide presentations and videos. At the same time, it should be accessible to the citizens of communities who need to be made aware of how certain street-level improvements, including environmental design applications, have the potential to improve their quality of life.

In terms of new federal initiatives, a more holistic approach is very timely. The Intermodal Surface Transportation Efficiency Act, recently enacted, will transfer more responsibilities to States and localities concerning use of Federal funds for transportation improvements. It also is offering more flexibility in how these funds can be spent—not just on more and better highways—but on a range of initiatives that will enhance the pedestrian and bicycling experience. Now is the time to capture the imagination of city officials, transportation planners, traffic engineers, and the community at large, with an approach that will build community while it also addresses larger traffic and environmental concerns. By drawing on the lessons of past design improvement programs, observing current problems and opportunities, and instituting an agenda for balancing mobility needs in a holistic context in downtown areas and other environments, positive and lasting conditions can be created for increased pedestrian and bicycle use.

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