
Bicycle and Pedestrian Programs

Bicycle and Pedestrian Programs

■ Introduction

Bicycling and walking, for many short to mid-length trips, represent alternatives to use of a single occupancy vehicle. Each trip shifted from a single occupancy vehicle to a bicycle or to walking results in a 100% reduction in vehicle emissions for that trip. In estimating the potential for bicycling and walking as alternatives to auto travel, it is important to take into consideration known factors that affect the choice of travel mode. For example, trip distance is a factor. Most bicycle trips are five miles or less in length, and most walk trips are less than one half mile. The physical condition of the trip maker also affects whether or not the trip can be shifted to these modes. Commuters in the 25 to 40 age group are most likely to bicycle to work. Weather conditions also may affect the extent to which bicycling and walking represent viable alternatives to driving or transit.

Bicycling and walking, though, do represent a viable alternative to driving for many trips. The key to attracting trips to these modes is to create safe, attractive, and convenient facilities for those who choose to commute by these modes, and to educate and inform the public about these commute options.

Until the 1970's, bicycling was considered strictly a recreational activity. In the early 1970's, as bicycling underwent a renaissance and the country faced its first oil crisis, bicycling received a lot of attention not only as an attractive recreational activity, but as a viable commute alternative. Many communities developed bicycle plans and built bicycle facilities. University communities led the way in developing bicycle facilities, because the student population represented a good target market for bicycle commuting (i.e., young persons without access to automobiles). In step with the fitness craze of the mid to late 1980's, bicycling has once again received headlines as a viable alternative to trips made by automobile.

The idea of walking as a means of transportation is not as widely recognized as an alternative to using an automobile. One major reason for this is that the distance one can conveniently travel by walking is much shorter, and in these days of suburban residential and employment development, walking does not always represent a viable alternative. However, there are numerous trips that can be made by foot, or by a combination of transit and foot, and some states and communities are developing pedestrian plans to enhance the opportunities for pedestrian trips. Increasingly, criteria for both pedestrian circulation and bicycle travel are being incorporated into the requirements for the development of new activity centers.

■ Description of Measures

Bicycle Facilities

Bicycle facilities can include a wide array of elements. These elements may vary with the characteristics of the community in which they are being developed, the target market, and the budget of the administering agency. As with other transportation measures, stability of funding and effective enforcement are key to achieving effective utilization. The most common types of bicycle facilities include the following:

Bicycle Routes, Lanes and Paths

The most fundamental element of a bicycle program is the development of a system of roadways or paths that are safe for bicycling. There are typically three types of facilities that can be developed for use by a bicycle. **Bicycle routes** refer to streets that have been designated for use by bicycles and which are marked for such use with signs. The bicyclist share the roadway with automobiles, generally riding in the right hand lane adjacent to the curb. Bicycle routes in no way separate the bicycle traffic from the general flow of automobile traffic. **Bicycle lanes** are located in the roadway utilized by automobiles, but the roadway space to be utilized by bicycle is clearly striped with paint. These lanes are either for the exclusive use of bicycles, or are marked for shared use (e.g., bus and bicycles; parking and bicycles; right turns and bicycles; etc.). No through automobile traffic is allowed in bicycle lanes. Bicycle lanes are usually a minimum of five feet in width. The American Association of State Highway and Transportation Officials (AASHTO) has established guidelines for the development of bicycle lanes. **Bicycle paths** are facilities built exclusively for bicycles (or non-motorized vehicles and pedestrians) and are totally separated from the flow of automobiles. Bicycle paths frequently are built for recreational purposes and can accommodate two-way travel. Bicycle paths can be provided either immediately adjacent to a roadway or as part of an independent right-of-way. Converting a portion of an abandoned railroad to a bicycle (or pedestrian) path would be an example of an off-road bicycle facility. The components of off-road facilities for bicycles (and pedestrians) do not differ substantially from the components of the individual programs and facilities. Important elements of the off-road facilities include linkage to other facilities, utilization of safe construction materials (e.g., gravel should not be used for bicycle paths), provision of adequate lines of site, and sufficient space for joint use and two-way traffic.

Bicycle Plans and Maps

A regional or community bicycle program should consist of an interconnected system of bicycle routes, lanes, paths, and "greenways" that provides recreational as well as "alternative transportation" opportunities. Most areas having such a well-established bicycle network have an established bicycle plan created by the city or county planning or transportation department. The bicycle plan should detail a well thought out continuous system of streets that provide through access between activities centers and residential areas. The plan will generally establish the bicycle network on secondary

streets with less traffic than arterials, but which provide relatively direct routes between points. **Bicycle maps**, which detail the network, are generally produced by the administering department, local bicycle groups, or bicycle stores.

Bicycle Coordinators

Another key component to plan development and administration is the **Bicycle coordinator**. The bicycle coordinator is usually a city or county employee working in the transportation or engineering department responsible for overseeing the development of the bicycle system, its maintenance, and the continued development of new bicycle programs. This position is critical to a successful program. The bicycle coordinator frequently serves a dual role as the pedestrian coordinator.

Lockers, Racks and Other Storage Facilities

Storage facilities are an essential component of a successful bicycling network. Cyclists must feel confident that their bicycles will be safe from vandalism and theft when left unattended while working, shopping or conducting other activities. Bicycle lockers and racks are provided by many employers, cities and transit agencies to encourage cyclists to ride to their destinations. **Lockers** comprise the highest level of bicycle security. They are enclosed facilities that totally protect the bicycle from theft, vandalism, direct sunlight and inclement weather. Lockers generally hold one to two bicycles, and can be rented at monthly rates or provided by owners as an employee benefit. **Bicycle racks** provide a freestanding structure that cyclists can lock bicycles to for security. They do not enclose the bicycle, so the cycles are still exposed to vandalism, direct sun, and bad weather. A single bicycle rack can generally provide storage space for several bicycles. Variations on racks include **posts** and **ribbons**. Posts accommodate one to two bicycles, while ribbons can hold several bikes. Both are exposed to the elements. Lockers are by far the most secure and the most expensive of these facilities, and they are also preferred by cyclists who will be leaving bikes unattended for long periods of time.

Bicycle storage facilities should be placed at locations supported by adequate lighting because commuters may be arriving and leaving at early and late hours. Bike parking user security is a priority and the user needs lighting that is adequate to permit seeing the door's access with keys.

Bicycle parking sites should have improved surfaces, not grass or stones, surrounding the bicycle storage lockers installed on a concrete pad. Pavers and like surface treatment will improve the chance to attract the non-cyclist to the facility.

Ancillary Facilities

The success of bicycle (as well as pedestrian) programs is enhanced by provision of **showers** and **clothing lockers** at the work place. Showers allow cyclists to wash up after the commute, and lockers can be used to store work clothes and/or riding clothes. These facilities provide a proven incentive to encourage employees to cycle to work and also can be used to support wellness/fitness programs.

Integration with Transit

Bicycle usage for longer trips can be enhanced by facilitating the use of transit by bicyclists. Providing secure bicycle storage at transit stations is one possibility. Another option is to allow bicycles to be carried on the rapid transit vehicle or rail car, with possible restrictions as to the number of transit cars that can be used for such purposes or the time periods of the day in which such use is permitted. Buses also can be outfitted with special bicycle storage racks.

Ordinances

Ordinances specifically aimed at addressing the needs of cyclists have been included in bicycle programs in recent years. Several cities such as Tucson, Seattle, Madison, and Dallas have ordinances that require that a certain defined proportion of parking spaces at new developments be set aside for bicycle parking. The City of Palo Alto, California has gone further, by requiring that new developments must include shower facilities to encourage bicycling. The ordinances differ by community, based on the characteristics of each, and the political realities in getting such a regulation passed.

Education

Several communities have established a special education program to train bicyclists as well as motorists about safety issues. These programs are frequently conducted through the school system. Sponsors can include the local government, the police department, bicycle clubs, medical associations, and others. Some cities have also developed education programs for their employees involved in construction of the bicycle facilities. These programs are aimed at sensitizing engineers to the needs of the cyclist.

Media and Promotion

Many bicycle programs include a marketing campaign to make both cyclists and motor vehicle operators aware of the bicycle program. The media campaign can focus on safety, education, or general efforts to attract people to the bicycle system. Media campaigns frequently include posters, brochures, radio advertising and special events such as bicycle rodeos and "bike to work days." Media and promotion is carried out by local government in some communities, and by bicycle clubs in others.

Bicyclists should be informed of the bicycle parking lots location with directional roadway signs. Marketing is as important as planning and development of facilities. New bicycle parking areas should be promoted, as well as an overall park-and-ride program.

Pedestrian Facilities and Programs

Pedestrian facilities have received much less attention than bicycle facilities. However, in recent years, the interest in developing good pedestrian facilities has increased. Efforts are underway by groups such as the Pedestrian Federation of America to increase the attractiveness of walking as an alternative to other modes. Some of the components of a good pedestrian program include the following:

Sidewalks and Walkways

Most fundamentally, pedestrian facilities must be provided. While it is normal to include sidewalks as part of most urban street systems, it is not unusual for suburban residential, employment and activity centers to be constructed without sidewalk or other related pedestrian amenities. Any trip, no matter how short, must then be made by car, or alternatively, walkers are forced to travel "cross-country." A related suburban design requirement to facilitate walk trips is to locate buildings and activities in such a way that distances are short and that walking is therefore encouraged.

Safe Facilities

Safety is a major concern of would-be pedestrians. This includes safe places to cross the street as well as mechanisms for insuring personal safety while walking on sidewalks. Crosswalks are one major component of a safe program. Crosswalks should be well marked and, at busy intersections, crosswalks should be accompanied by walk signals. Signals should be long enough in duration to allow pedestrians to cross the streets without feeling threatened by a potential signal change. Wide boulevards and busy intersections can also include a **median strip** where pedestrians can rest and wait for the next signal before completing their trip across the street. Some communities have experimented with **speed bumps** at intersections with heavy pedestrian use in an effort to slow traffic.

Elements that enhance safety on sidewalks includes provision of wide enough sidewalks separated from the flow of traffic on adjacent streets by a terrace or other barrier. **Lighting** is an important element for enhancing safety, as is elimination of objects that people can hide behind. A **clear sight line** that allows the pedestrian to see quite far in the direction that he or she is headed is also an important safety feature.

Pleasant Environment

Another feature of a successful pedestrian system is a pleasant environment for walking. Elements include **benches**, **street level shops** for browsing, and **fountains and other amenities**.

Connections with Transit

Many pedestrians also use transit for a portion of their trip. Provision of good pedestrian facilities connected to the transit system will encourage multi-modal trips. **Shelters** at transit stops with **direct access** to sidewalks is critical.

Education

Many communities have found that programs to educate people about safety issues associated with walking is important. Programs conducted in elementary schools and at senior citizen centers are particularly important. Issues such as the importance of crossing at cross walks, looking both ways, and being a defensive pedestrian (i.e., don't challenge autos, wear light colored clothes at night, etc.) are important topics.

■ Examples

Several cities have incorporated extensive bicycling programs into their transportation plans. Some of the most successful bicycling programs have been implemented in college towns, where a large portion of the population is dependent on public transportation, bicycling or walking. However, there are also examples of large cities that have implemented successful programs. In this section, bicycle programs in Seattle (WA), Tucson (AZ), and Madison (WI) are highlighted. Also highlighted is Fleetwood Enterprises, Inc.'s employer-based program.

While the conversion of railroad right-of-ways and other trails to pedestrian and bicycle facilities has primarily served recreational trips, there are also examples where commuters use these facilities. Two such facilities, one in Marin County (CA) and one in Northampton County (PA), are described.

Effective pedestrian programs are less prevalent, primarily because walking traditionally has not been considered a viable alternative for many trips. However, pedestrian facilities are being incorporated into more and more transportation plans, and pedestrian access provisions increasingly are being incorporated into urban design standards affecting major new developments. The State of Florida's pedestrian plan, represents one such example that provides useful background for communities considering pedestrian programs.

Bicycle Programs

City of Tucson, Arizona

The City of Tucson (population approximately 350,000) and Pima County have developed a comprehensive bicycle plan and program to encourage commuters to ride bicycles to work. The City is conducive to bicycling for several reasons. The street network was constructed with wide lanes that were easily converted into bicycle lanes. The topography is relatively flat, and the street system is laid out on a grid, which means that less congested (safer) secondary routes do not require significant extra time to travel. There is a high percentage of sunny days, and, for eight months of the year, there are no extremes in temperature. (The remaining four months are during the hot summer season.)

The City began designating bicycle facilities in 1971. By 1974, 50 miles of bike routes had been designated. By 1980, there were over 100 miles of bicycle lanes. The 1980 Regional Transportation Plan developed by the Pima County Association of Governments included a large amount of bicycle facilities through the provision of wide outside, multi-purpose lanes (e.g., a combination of bicycle lanes and breakdown lanes).

A major influence in the development of the Tucson bicycle program came in 1985. In that year, the City Council revised the "Major Streets and Routes Plan," defining design and development standards for major streets within the city, including bicycle

improvements. Since that time, roadway improvement projects for major and collector streets have included a 17 foot wide outside lane to accommodate bicycles. The outside five feet is striped as a bicycle lane. The development of these facilities is funded through Highway User Revenue Funds, and a \$220,000 per year bicycle capital improvement fund (from the General Fund). Eventually, all major and collector roads will be striped.

In 1988, the City provided support staff to the Tucson/Pima County Bicycle Advisory Committee (T/PCBAC). The T/PCBAC is a citizen appointed advisory committee devoted to increasing bicycle awareness and programs. The T/PCBAC has played a major role in establishing bicycle policy and programs in the City and County.

In 1989, the City hired a full-time alternate modes coordinator who devotes significant time to bicycle facilities. The job of the Coordinator is to oversee all bicycle programs, manage bicycle demonstration programs, identify funding for the bike map, organize major bicycle events, address pedestrian issues, and work with the National Park Service on developing trail programs.

Another major milestone was accomplished in April 1990, when the Tucson City Council passed an amendment to the off-street parking ordinance that requires provision of bicycle parking. The amount of bicycle parking required varies by use, but averages about eight spaces per hundred automobile spaces. Passage of the measure required extensive efforts on the part of the transportation and planning staffs, the T/PCBAC, and other interest groups. The ordinance requires both Class I (i.e., lockers) and Class II (i.e., racks) parking facilities for both employees and customers.

Several ongoing efforts include an inventory of all existing facilities, including lighting on routes and pavement conditions. This inventory, which is funded with a \$5,000 Arizona Department of Environmental Quality grant, will be computerized to allow easy updating. An Arizona Department of Transportation grant is currently being used to purchase 33 bicycle lockers for park and ride lots and downtown. The racks will rent for \$2.00 per month. There is an ongoing demonstration program to purchase six bicycle racks for buses to integrate the two modes. Demonstration routes still need to be identified. Finally, the City is considering converting four lane collector streets into two lane streets with a turning lane and bike lanes. This is being tried on two lane segments at the current time.

Additional components of the Tucson program include strong coordination between the City and the Pima Association of Governments (PAG), a strong and active officially appointed citizens' advisory groups, integrated marketing, enforcement and education. The City takes prime responsibility for all construction and maintenance projects, and also produces a bicycle commuter handbook. The handbook was funded by a grant obtained by the Citizen's Advisory Committee. The PAG is responsible for education and marketing. The education program is coordinated with the State Bicycle Safety Task Force, which utilizes pediatricians, police and firemen to present education programs at the schools and summer camps. Marketing techniques include production of route maps, alternate mode campaigns, posters, brochures, etc. The T/PCBAC is active in identifying needs and in garnering support for legislation and key projects. There is also

significant coordination with the Alternate Modes Coordinator at the University. The City has a mounted police patrol that monitors the facilities.

As of 1991, the City has 300 miles of bicycle lanes. The installation of lanes has become institutionalized, which means that the advocacy groups and alternate modes coordinator do not have to fight for bicycle lanes on every rehabilitation or new construction project.

Currently about 3.5% of work trips are made by bicycle. Since it is estimated that approximately 65% of all Tucson area trips are five miles or less, there is still a large untapped market.

The success of the Tucson program is attributed to several reasons. Coordination and clear delineation of the roles of participating agencies and organization is essential. It is also essential to have a strong, well-organized, and officially-appointed citizens' group. A full time staff person is necessary to oversee project work and to manage demonstration projects. Education and enforcement are also key elements of the program.

The cost of the program includes staff time, publication costs, and construction and maintenance costs. Staff costs are currently approximately \$75,000 annually. The City's capital fund for bikeways is \$220,000 annually. Map publication costs average \$5,000 for 2,000 to 3,000 maps. Grants are used for special publications and projects. Funding sources for construction, maintenance, and other programs include federal transportation planning funds, City General Funds, and bicycle club donations. Because bike lanes are now required by law to be built into new or rehabilitated roadways, these costs are included in the City's road construction and rehabilitation budget.

Seattle, Washington

The City of Seattle, with a population of over 500,000, has one of the most comprehensive bicycle programs for a city of its size. The program got off the ground in the early 1980's, when oil prices increased rapidly. Seattle's bicycle program includes four major elements, each directed by a different group. The City's transportation department is responsible for construction and maintenance of facilities. Enforcement is the responsibility of the police. Promotional activities are spearheaded by local bicycle clubs, and education is conducted through a program at local hospitals. This division of labor is felt to make sense for Seattle and has been crucial for most effectively utilizing resources.

The goal of the City's bicycle program is to create an environment where people can ride safely. The majority of Seattle's 145 miles of bicycle facilities are bicycle routes. The City also has a system of interconnecting trails, primarily used for recreational purposes. Because Seattle is a city surrounded by waterways, bridges are an important part of the transportation system. Bicycle access across bridges is crucial in order to provide a well-linked bicycle network. The City passed an ordinance that requires all new or rehabilitated bridges to provide bicycle and pedestrian access. On the one main bridge that currently does not have a bicycle lane, buses are equipped with racks to transport cyclists across the bridge.

Bicycle parking is also an important component of the City's bicycle program. As required by a City ordinance, 10% to 15% of all parking at new developments must be for bicycles. The City also has an annual bicycle rack fund, and will place bicycle racks at any commercial area "with a public feeling" until the fund is depleted. The fund is used to purchase between 60 and 80 racks per year.

The education element of the City's program is unique and important. Bicycle education is done through a local hospital, where pediatricians are involved in stressing the importance of bicycle safety and the use of helmets to parents. Doctors display helmet posters in their offices. Participation by doctors is considered crucial because doctors are seen as authority figures, and their bicycle safety instructions are often considered to be based more in reality than the advice of others. A local helmet manufacturer contributed to the program by providing discounts for the purchase of kids' helmets to bring costs down. Schools offer bicycle education programs, and the Cascade Bicycle Club sponsors assemblies and bike rodeos at the schools to teach bicycle education.

Safety is monitored by the City through an accident tracking system. All bicycle accidents are mapped, and if any particular spot shows a concentration of accidents, efforts are made to determine and correct the cause. The City also relies on citizens to report dangerous conditions by filling out "Bike Spot Forms."

The City has over 30 police officers on bicycles, who survey compliance with bicycle rules and regulations. A study of enforcement is currently underway.

Seattle spends approximately \$6,000,000 annually on its bicycle program. This includes the cost of five full time bicycle/pedestrian specialists, the bike element of street projects (approximately 2% to 3% of a project's total cost), publication of 15,000 maps per year at \$0.25 per map, maintenance costs (which include such activities as cutting bushes so they do not protrude into the bicycle lanes), land acquisition, paint for striping, etc.

Three key components of Seattle's program are the level of citizen participation, the extent of training given to planners, and the existence of a bicycle coordinator. Citizen participation has taken three forms in Seattle. The Cascade Bicycle Club, a strong and active advocacy group, has a government affairs committee that monitors the City's bicycle program and campaigns for local legislation that supports bicycle facilities. There is also a Bicycle Advisory Board appointed by the mayor, which meets once each month to discuss bicycling issues in the City. Finally, there are several strong independent neighborhood and citizen groups that lobby for bicycle programs.

Planners and engineers involved in projects that affect cycling are given training to understand the needs of cyclists. They are also trained to understand the design requirements necessary to create safe and effective bicycle facilities. The bicycle coordinator institutionalizes the bicycle program, and ensures that bicycle facilities are built into every project that makes sense.

Madison, Wisconsin

Madison is a mid-sized city, the home of the main campus of the University of Wisconsin, and also the Wisconsin State capital. The City has a considerable population that utilizes bicycles for trips other than recreational trips. Approximately 20% of the students (25% to 30% of those who live off-campus, and 10% to 12% of university employees) commute by bicycle. In 1980, 11% of summer commute trips were made by bicycle.

Bicycle planning in Madison began in 1972. In that year, the City's Master Plan included bike routes. In 1975, the City produced a long range bicycle plan. Today, bicycle facilities in Madison include a mixture of routes, lanes and trails, totaling approximately 100 miles.

For the most part, the City follows guidelines of the American Association of State Highway and Transportation Officials (AASHTO) for the construction of bicycle facilities. Bicycle lanes are constructed to be 5 feet in width outside the gutter section of the road. Lanes are signed to allow for combined use. Some lanes allow parking and right turns as well as bicycles, some allow for buses and right turns, and others only allow for bicycles and right turns. The decision on what uses are allowed in the bicycle lane is made on a case by case basis, depending on the road conditions and use.

Madison converted a contra-flow bus lane on University Avenue into a contra-flow bicycle lane. The contra-flow lane is heavily used, but also has a high accident rate caused by collisions between cyclists and left turning vehicles. University Avenue also has wide (8 foot) bicycle lanes that flow with the traffic.

In 1988, the City passed an ordinance that requires that 10% of all parking at new developments outside the central business district be for bicycles. Within the central business district, the City does not require any parking for automobiles, but does require bicycle parking.

Citizen involvement plays a key role in Madison's bicycle program. A bicycle subcommittee has been established as part of the Transportation Commission. This subcommittee ensures that the Commission adequately addresses bicycle needs.

Education is done through the schools. Education programs are conducted by two staff persons, whose salaries are paid through a grant. The City publishes a bicycle map that includes safety instructions. The Police Department has developed an enforcement program that utilizes eight to ten civilians annually. These citizens are empowered to issue citations to cyclists who do not follow the rules of the road. The full-time bicycle coordinator plans the system, works with the engineering department to ensure that bicycle facilities are included in new construction projects, and monitors the overall bicycle program.

The capital budget for the Madison bicycle program was between \$125-150,000 annually until four years ago. The capital program is currently funded at \$65-85,000 annually.

(The cost of facilities such as freeway underpasses are not funded from this pot of money.) State Department of Transportation funds are used for publications. A separate operating budget covers the salary of the bicycle coordinator.

Fleetwood Enterprises, Inc.

Fleetwood Enterprises, Inc. is a 600-employee manufacturer of recreational vehicles and pre-fabricated homes with its headquarters in Riverside, California. The company has a commuter services department whose role is to promote alternative commute modes. Through the commuter services department, with input from top management and several committed cyclists, the company established a program to encourage commuters to bicycle to work. The program is called Mud, Sweat and Gears. The program includes the following components:

- To make up for the time sacrificed by cycling, cyclists can earn credits toward the purchase of merchandise or services offered through a special commuter catalogue, or toward bonus days off from work.
- The company makes available showers and assigned lockers for cyclists.
- Company-designed and fabricated lockers are strategically placed throughout the 30+ acre site.
- Cyclists who commit to ride three or more times per week receive a free reflective vest and helmet.
- The cyclists developed a route map which details each participant's route to work so that participants can meet and ride together.
- The company has purchased several bicycles that are loaned to employees who want to try cycling to work. After a 30 to 90 day trial period, the employee can purchase the bike at a substantially reduced cost if he or she commits to riding at least three days each week.
- A mirror and night light are provided to all participants at no cost.
- The company publishes bicycle safety tips.
- The company maintains a bicycle repair shop with qualified bicycle mechanics, and also sends a vehicle to pick up cyclists with mechanical problems on the road.

These main features of the program are supplemented by on-site bicycle maintenance clinics, a guaranteed ride home program, forgiveness for occasional tardiness caused by the bike commute, monthly drawings and prizes for bike commuters, employee discounts at local bike shops, lunch rides, and lobby posters and publicity.

Over 6% (35 bicycle commuters) of the 600 employees enrolled in the program during the first four months of 1991 to commute at least two days each week, with some riding

bicycles to work every day. The company held a bike to work day in May, 1991; 130 employees participated and management cooked breakfast for the cyclists. Since that time, participation has doubled with 12% (75 people) of all employees cycling to work on a regular basis.

Other companies also have developed innovative incentive programs to encourage the use of "alternative" transportation modes to the single occupant auto. Hewlett-Packard in California, in a program called "Commuter Credit Card," gives employees \$4.00 per day in gifts to use alternative modes. In a program called "Give a Buck, Take a Buck," Rockwell International employees who bike to work receive from \$15 to \$30 per month. Other employers give a transportation allowance to each employee. Those employees who drive to work and utilize a previously free company-provided parking space are charged an amount equal to the transportation allowance. Those who bike to work or utilize some other alternative mode get to keep the allowance.

Mill Valley-Sausalito Path, California, Off-Road Bicycle and Pedestrian Facilities

Mill Valley and Sausalito are located in Marin County, California, across the Golden Gate Bridge from San Francisco. As documented by the Rails-to-Trails Conservancy in Railroads Recycled, the 2.5 mile long Mill Valley-Sausalito Path was created from an abandoned railroad corridor into a path utilized by pedestrians, cyclists and runners. While much of the path's activities are recreational in nature, the path is also utilized by commuters. Although the trail itself is short, it can be utilized by both bicycle and pedestrian commuters because it links up with other facilities. At its southern terminus, the trail joins a bicycle route that hooks up with the bicycle lanes across the Golden Gate Bridge into San Francisco. The trail also ends in close proximity to the Sausalito Ferry, which commuters use to travel to downtown San Francisco.

The acquisition and development of the trail cost \$1,002,675 (1978 dollars), of which \$835,200 was provided by a grant from the then existing federal Rails-to-Trails program. The California Department of Transportation contributed \$93,000 to help with development costs, in recognition of the trail's potential commuter use.

The trail was built and is maintained by the Marin County Department of Parks, Open Space and Cultural Services. Development of the trail entailed reconstruction of two bridges, construction of a bikeway, and development of a trail head.

National Trails Towpath Bike Trail of Palmer and Bethlehem Townships, Northampton County, Pennsylvania

Palmer and Bethlehem Townships in Pennsylvania are located in the Allentown metropolitan area. The Townships include the communities of Palmer, Bethlehem, Easton, Wilson, and West Easton, with a total population of approximately 27,000.

As reported in the Rails-to-Trails Conservancy's Railroads Recycled, the two Townships applied for and received a grant for \$563,050 through the federal Rails-to-Trails program. The total cost to acquire and develop the trail was \$617,606. Development included paving, trail markings, amenities such as benches, and landscaping. Property

acquisition cost totaled \$198,400 and construction cost \$419,206. The project development was overseen by the Northampton County Board of Supervisors.

The trail is 7.8 miles in length, of which 4.4 miles is part of the abandoned rail corridor. The remaining 3.4 miles of trail was developed from an existing road. One lane of the road was converted into a bicycle path, and the remaining lane is now used for one-way traffic.

The trail is maintained by the parks and recreation departments of the two townships. Each is responsible for that section of trail located within their jurisdiction. Maintenance costs have been minor to date. This year, the towns do expect to spend some money to repair some areas damaged by roots.

The trail is used predominantly for walking, as well as for bicycling and cross country skiing. Approximately 30% of those using the trail are doing so for purposes other than recreation, such as commuting to work, school, the post office and shopping areas. The trail comes within a short distance of one major shopping strip, and also abuts the regional post office. There are benches, water fountains and rest rooms located along portions of the trail.

Safety has not been a major issue. The trail crosses streets at three points, but the streets are well-signed and there have been few accidents reported at these intersections.

Pedestrian Programs

Overall, efforts to encourage more pedestrian trips are still in their infancy relative to bicycle programs. The City of Boulder, in addition to having a major bicycling program, also sponsors an annual Pedestrian Conference to address pedestrian issues. Grass roots organizations such as Walk Boston are working to provide better pedestrian environments, and to ensure that good pedestrian connections exist between transit and activity centers. However, this area needs considerably more attention. The following is one example of an innovative pedestrian program.

Florida Pedestrian System Plan

The Florida Pedestrian System Plan was developed in 1989 in response to the State's growing concern over the pedestrian environment in most of its cities. Approximately one-third of Florida's population is transportation disadvantaged; their lifestyle or economic condition force them to walk. This includes a growing population of older persons who can no longer drive, and children who walk to school. In addition, the state has a large population of visiting drivers, who do not know the road systems. Many developments that were built prior to the State's recent growth were built without sidewalks, and pedestrian amenities have been included in the design of very few new developments. Housing is not built close to shopping facilities, and many housing developments have been built without sidewalks. As a result of these factors, Florida has the highest pedestrian fatality rate of any state in the nation.

In an effort to encourage walking for short trips, and to make walking safe, the State hired a pedestrian coordinator and, with a grant from the Governor's Energy Office, developed the Pedestrian System Plan. The Plan included extensive research as to pedestrian programs in other states, and significant survey work. The DOT developed a Pedestrian Coordinator Manual for use by local transportation planners, provided training for local pedestrian coordinators, and prepared several public service announcements to inform the public about the State's efforts to improve walking conditions in urban areas.

The Florida Pedestrian System Plan was developed to incorporate several system characteristics, as defined by John Fruin in his book entitled, Pedestrian Planning and Design. These characteristics are:

- Safety;
- Security;
- Convenience;
- Continuity;
- System Coherence; and
- Comfort and Attractiveness.

The goals of the program are:

- To dramatically reduce the number of pedestrian accidents, injuries, and fatalities in the State;
- To make all public facilities in the State accessible by foot;
- To create an urban and suburban environment that is conducive to walking; and
- To reduce energy consumption by increasing the number of short trips made on foot.

The Florida Pedestrian System Plan includes a variety of recommendations for achieving better pedestrian conditions in the State, and for increasing the walk mode share. The major recommendations are summarized below.

- Institute sidewalk construction programs in all areas to correct current deficiencies.
- Widen existing sidewalks so as to more easily accommodate obstructions where they occur.
- Construct bus stops with adequate sidewalk access.

- Avoid using standard rural cross section design standards (with no provision for sidewalks) where pedestrian usage is likely. Instead, convert to a cross-section design that is more urban in character.
- Road resurfacing projects should avoid lips over more than 2 inches to provide for wheelchair use.
- Crosswalks should be considered where there is pedestrian demand.
- Other pedestrian aids, such as signals, pushbuttons, raised median strips, mid-block crosswalks, etc. should be installed where there is pedestrian demand.
- All existing facilities should be brought up to minimum standards for handicapped access.
- Painted stop bars must be at least four feet from a marked crosswalk.
- Maintenance programs must be implemented.
- All traffic engineers and planners should receive training in pedestrian needs.
- All children between 5 and 13 should receive pedestrian education in school.
- Development of a public information program for parents.
- Training for law enforcement personnel.
- Development of a campaign to encourage Floridians to walk more.
- Development of maps, signs and kiosks to inform pedestrians about the best routes, etc.
- Establishment of full-time pedestrian coordinators for all urbanized areas.

The Florida pedestrian plan is still in its implementation stage, and planners have found that the process is slow because there is very little awareness about pedestrian issues in the state. However, the state is spending \$200,000 annually to improve pedestrian conditions. Twenty-five cities currently have paid pedestrian coordinators (some of whom are also responsible for bicycle programs). The state is also working hard to help communities develop design guidelines that incorporate pedestrian facilities.

■ Program Impacts

A shift of automobile trips to either bicycle or walk trips has a direct, positive impact on vehicle emissions, with auto emissions per trip reduced by 100%. Bicycling and walking

realistically can substitute for relatively short trips (i.e., generally less than five miles in length). However, the reduction in air pollutants per mile of travel is greater than if longer trips were diverted to other modes because the greatest pollution occurs during the cold start.

The Florida Department of Transportation estimated the air quality impacts that could be realized if 0.5% of auto trips were shifted to pedestrian trips. Assuming that the gasoline fleet mileage is 18.2 miles per gallon, and the average trip length made by bicycle is 0.5 miles, the State estimated that the annual gasoline savings would be 6,187 gallons per day. This would result in an emissions reduction of:

- 524 tons of hydrocarbons;
- 4,245 tons of carbon monoxide; and
- 468 tons of nitrogen oxides.

These estimates are considered to be conservative for several reasons. First, a 0.5% shift to walking is conservative because it does not allow for a shift from long trips to a combination of walking and public transit if walking access to transit is improved. Also, the assumed average miles per gallon for the fleet is for all auto trips, while trips of short duration usually have a fuel economy somewhat less than the average, resulting in higher emissions levels.

The air quality impacts of a shift in auto trips to bicycle trips has been calculated for several cities and states, and reported in the newsletter of the League of American Wheelmen. For example, in the State Implementation Plan for the State of Oklahoma, it is estimated that a twenty-five mile network of bicycle facilities would result in a 1% modal shift to bicycles, and a corresponding 0.4% reduction in air pollutants. A report published by the University of Wisconsin estimated that a 50% increase in commute trips made by bicycle would result in a 6.56% reduction in hydrocarbons, a 7% reduction in carbon monoxide, and a 14.97% reduction in nitrogen oxides. If the share of commute trips made by bicycle increased by 100%, hydrocarbon emissions would be reduced by 13.12%, carbon monoxide by 13.46%, and nitrogen oxide by 20.86%.

■ Other Benefits and Costs

Bicycle and pedestrian programs provide several benefits. There are certainly health benefits associated with the increased exercise demands of a bicycle or walk commute. These benefits accrue not only to the individual, but also to companies whose employees walk or bicycle to work because these employees tend to be healthier and to miss fewer work days.

Bicycling is also a low cost option for commuters. The equipment necessary to bicycle is relatively inexpensive compared to an automobile. The only equipment necessary for walking is a good pair of walking shoes.

Space requirements for the storage of bicycles is about one-twelfth that necessary for automobile parking. Therefore, a successful bicycle program means that less space (and cost) will be required to provide parking for employees, shoppers, etc. Again, walking requires no space for parking a vehicle.

Investment in bicycle and/or pedestrian facilities can be an investment in both recreation and the commuter. This means that dollars spent for facilities do double duty, and should reduce the overall cost of a community' programs.

There are some real costs associated with bicycle and pedestrian programs and facilities. The bicyclist and pedestrian are limited to a smaller range of travel. Travel time requirements also may be longer (although during congested periods, cyclists can often travel faster than autos). Bicycles provide less cargo room than does a car, so transporting goods can be difficult. This is also true for walk trips. Both walking and bicycling are easier in good weather. In some cities, such as Seattle and Eugene, Oregon, there are numerous bicycle commuters who continue to commute by bike even during seasons when the weather does not encourage such commutes. However, rain, excessive heat, snow, and cold weather all reduce participation in bicycle and walk commuting.

A weakness in pedestrian and bicycle programs can occur if there are missing links in the system. For example, if there is not a continuous bike route or lane along a commute corridor, cyclists will be discouraged from using the corridor. One missing link can result in a failed program.

Education can prove to be a weak point in a bicycle program. This includes education of the cyclists, drivers, and city staff involved in developing the facilities. If education is not provided, accident rates can be high, the system can be poorly designed, and participation in the program can be discouraged.

There are several different costs associated with developing, maintaining, and operating a bicycle or pedestrian program. As is clear from the case studies described, costs vary considerably from community to community. Costs include:

- **Salary and benefits for a program coordinator and other staff;**
- **Land acquisition;**
- **Bike lane construction (included in roadway costs);**
- **Bike path construction (approximately \$15/linear foot, not including clearing, retaining walls, land acquisition);**
- **Publications (e.g., maps, which range fro \$0.25 to \$2.00 per map);**

- Bicycle lockers (\$450 to \$3,500, depending on design; one bike stall requires 22.5 sq. ft. compared to 300 sq. ft. for auto parking);
- Bicycle racks (\$60 to \$900);
- Special events;
- Signage, striping (In California, estimated costs are \$500 per mile for bicycle route signing, and \$2,500 per mile for signing, striping, and pavement stenciling of a bike lane);
- Maintenance;
- Enforcement; and
- Educational materials.

■ Implementation Considerations

The political, socio-economic, fiscal, and physical characteristics of each community play an especially important role in the design of bicycle/pedestrian programs and supporting facilities. What may be reasonable in one community as a bicycling or walking alternative may prove to be unacceptable in another community. However, there are several elements related to the implementation of successful programs that are worth consideration by all communities embarking on bicycle and pedestrian programs. These are listed below.

- **Bicycle and/or Pedestrian Coordinator.** The success of a bicycle program requires continuous monitoring and proactive support. The most successful programs include a bicycle coordinator, usually a local government employee, who oversees the planning and development of the system. The job of the coordinator is to ensure that bicycle and pedestrian issues are considered in the construction and rehabilitation of all facilities that affect cyclists and pedestrians. The coordinator must ensure that all city staff involved with planning for and construction of bicycle and pedestrian facilities understand the needs of the cyclist and pedestrian. This can require training programs for staff. The coordinator must be an advocate for bicycling and walking with the city council, board of supervisors, the transportation department, and other policy and plan makers. The coordinator must also work with citizens groups, bicycle clubs and other advocacy groups to coordinate public and private sector efforts. While the coordinator may not be responsible for educational, enforcement and media events, he or she must be aware of all such programs.

- **Officially-Appointed Citizens' Advisory Committee.** Experience has shown that active citizen participation is essential to the development of a comprehensive bicycling program. Appointment of a citizens' advisory committees to represent bicycle and/or pedestrian issues to the the transportation commission or city council ensures that the interests of bicyclists and pedestrians will be heard. These groups are also essential for garnering support for ordinances that enhance bicycling and pedestrian programs.
- **Involvement of Private Groups and Businesses.** Bicycle clubs, bike shops, employers, hospitals and others can play a crucial role in bicycle and pedestrian programs. Groups such as the Bicycle Federation of America, the Rails to Trails Conservancy, the American Hiking Society, and the League of American Wheelmen may be of assistance. Private organizations frequently can provide necessary monetary support or in-kind contributions that can enhance a bicycle or pedestrian program. Also, private organizations can take responsibility for activities such as education and marketing, and even help to provide facility development and construction.

A private sector service providing commercial bicycle parking space could be viable where permission is granted to developers to install, operate and promote storage lockers at public transit sites. Examples of this private sector activity exist in Japan and Australia, among others. This is analogous to those areas where private operators provide and maintain quality transit shelters in return for permission to place display advertising on the structures to enable cost recovery of the shelter system investment.

- **Long Range Planning.** Any successful bicycle or pedestrian plan must include long range planning. The plan must evaluate where the facilities should be in five to ten years, and then make sure that every project affecting the plan addresses the needs of the plan. The long view is essential because sidewalks, roadways and bridges are constructed to last for long periods of time. If such construction occurs without consideration to the needs of cyclists and pedestrians, the opportunity to develop a well-linked system is lost for several years. The provision for bicycle and pedestrian travel is only a small part of a larger environmental and land use development process having deep historical roots. Consequently, short-range plans should be explicitly crafted so as to support the achievement of longer-run activity pattern goals. In this context, technical assistance from Federal agencies such as the Departments of Transportation and Interior may be particularly helpful.
- **Route Selection.** The selection of the most direct routes with the least traffic is important when developing bicycle facilities. It is also critical that routes do not include gaps where cyclists will face dangerous encounters with traffic, or other unsafe conditions. Bicycle paths should be used only when long stretches can be provided without any road crossings. Road crossings enhance chances of accidents because vehicles are not expecting cyclists to be entering the stream of traffic. For pedestrian paths, it is important that there are not barriers that require long, circuitous routes to reach destinations that are within a very short distance as the crow flies.

- **Geography and Weather.** Cities with a relatively flat geography are best for bicycle programs. In selecting routes, roads with the fewest changes in topography will be most utilized. Communities that have moderate weather for most of the year have a good climate for cycling and walking; some of the best programs (e.g., Boulder, Colorado; Madison, Wisconsin; Eugene, Oregon; Seattle, Washington), however, suffer from cold winters or rainy weather.
- **Education.** While many people consider themselves good bicyclists, and everyone who is physically able believes they know the ins and outs of walking, education programs are essential to ensure a safe and effective bicycle or pedestrian program. There are several bicycling rules of the road which may not be well-known to the average cyclist. Many cyclists do not know hand signals, do not obey traffic signals, do not know when to cross a busy lane of traffic, etc. Vehicle operators are also unsure of how to share the road with a cyclist. Pedestrians need to be instructed about how to guard against the hazards of vehicle/pedestrian interface. The most effective education programs are conducted in schools or other institutional settings, and are conducted by police, fire officials, and doctors. These individuals demand respect that translates into a belief that what they are saying is true. The extent to which doctors, in particular, can be drawn into educational programs is very important.
- **Integration with the Transit System.** If pedestrian and bicycle facilities can interface with the transit system, the opportunity for multi-modal, non-auto trips will be enhanced. To integrate bicycle facilities with transit, buses can be equipped with bicycle racks; high quality durable lockers can be provided at stations; and bicycles can be allowed on rapid transit facilities during commute hours. Pedestrian facilities can be integrated with transit by providing bus stops in residential neighborhoods, providing shelters at transit stops, and ensuring that pedestrian access to shelters from the sidewalk is easy and comfortable.
- **Provision of Ancillary Facilities at Destinations.** To best encourage bicycling for other than recreational trips, vandal resistant storage facilities should be provided at destinations such as employment centers and shopping districts. Provision of shower facilities at the work place is an important amenity for encouraging more work trips to be made by bicycle.

■ Bibliography

1. American Association of State Highway and Transportation Officials, Guide for Development of New Bicycle Facilities, Washington, D.C., 1981.
2. American Trails and the National Park Service, Trails for All Americans, Washington, D.C., 1990.

3. "America's 10 Best," in The Walking Magazine, July/August 1991.
4. Applied Science Associates, Inc., "Florida Pedestrian System Plan," Florida Department of Transportation, 1989.
5. Bergman, Abraham B., Frederick P. Rivara, Deborah D. Richards, and Lisa W. Rogers. "The Seattle Children's Bicycle Helmet Campaign," in American Journal of Disease of Children, June, 1990.
6. "10 Best Cycling Cities," in Bicycling, November 1988.
7. Fleetwood Enterprises, Inc., "1991 Mud, Sweat and Gears."
8. Fruin, John J., Ph.D., Pedestrian Planning and Design. New York NY: Metropolitan Association of Urban Designers and Environmental Planners, 1971.
9. Gobster, Paul H., "Urban Bicycle Trails: Use Patterns and User Preferences," Trends 25, no. 3, 1988.
10. League of American Wheelmen. How to ... Promote Bicycling as a Pollution Solution, 1989.
11. Mayer, Richard W., Bicycle Planning and Design, Landscape Architecture Information Series 1, no. 1, 1978.
12. National Park Service. Economic Benefits of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book. San Francisco, CA, 1990.
13. Nevel, Bonnie and Peter Harnik, "Railroads Recycled," Rails-to-Trails Conservancy, 1990.
14. _____. "A Trend on the Move: Commuting by Bicycle," Bicycling Magazine, 1991.
15. President's Commission on American Outdoors. Report and Recommendations to the President of the United States. Washington, D.C., U.S. Government Printing Office, 1986.
16. Untermann, Richard K., Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling. Seattle, WA, Van Nostrand Reinhold Co., 1984.
17. User Conflict Subgroup, National Trails Agenda Task Force. Report on the Ninth National Trails Symposium, Baltimore, MD, League of American Wheelmen, 1988.
18. Walker, "Of Bikes and Cars: An Urban Transportation Emissions Model," University of Wisconsin, July 8, 1988.