

Federal Highway Administration

FHWA Domestic Pedestrian Safety Scanning Tour

September 2005

**Portland, Maine
Durham, New Hampshire
Cambridge, Massachusetts
Seattle, Washington
Portland, Oregon
New York, New York**

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DEDICATION

On September 13, 1899, 68 year-old Henry H. Bliss paused to help a woman dismount from a New York City streetcar. He was then struck by a taxicab and died the next day, becoming the first person killed by a motor vehicle in the western hemisphere.

This report is dedicated to the memory of Mr. Bliss and the many other New York pedestrians that have been killed or injured since then.



This photo was taken in 1873, 26 years before his death.

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INTRODUCTION

The Problem: More Than One Pedestrian Fatality Per Day

Every year almost 5,000 pedestrians are killed on our nation's streets and highways. Nearly 70,000 pedestrians are injured. In New York approximately 340 pedestrians are killed and over 17,000 pedestrians are injured each year. In other words, on an average day in New York State, one pedestrian is killed and 50 are injured. Sixty-two percent of the state's pedestrian fatalities and 71 percent of the injuries occur in the five boroughs of New York City. New York City and Long Island combined have approximately 80 percent of the state's fatalities and serious injuries.

Children and older adults are at highest risk for pedestrian injury and death. In New York State 20 percent of all reported pedestrian injuries and fatalities occur among children 5 to 14 years old. Nationally, pedestrian and bicycle accidents are the third leading cause of injury-related deaths among children between 5 and 14. Elementary school-age children and the elderly are more likely to be struck by a motor vehicle, and statistics show their injuries tend to be more severe than any other age group. (Pedestrian and Bicycle Safety Education Program Rockville Pilot Program <http://www.rockvillemd.gov/recreation/bicycling/newsletter.htm>).

The cost to this nation and the State of New York in job-related loss and social cost for pedestrian deaths and injuries is staggering. In the United States the annual societal cost of pedestrian fatalities and injuries is \$14 billion and \$5 billion, respectively. In New York the societal cost of pedestrian fatalities and injuries is \$2 billion annually. Over one third of all pedestrian crashes result in a traumatic brain injury, with an average hospital stay of eight days; the mean hospital charge per stay is \$25,127, resulting in a total cost of \$90 million.

These dollar costs cannot even begin to convey the impact on the community and the emotional trauma to the families of those that are killed or injured, nor can they be truly quantified. Crash statistics are not just numbers, but represent people; family, friends and loved ones.

The Premise: The 20/10 Program

Federal Highway Administration (FHWA) safety programs are designed to reduce crashes, to minimize the impact of a crash should it occur, and to address pedestrian safety through the development of tools and training. Other FHWA programs seek to reduce the time from the moment a crash occurs to the time that first responders are on the scene and the time it takes to get the injured to critical care, thus maximizing the potential to survive while lessening the risk of more serious injury.

In 1999 the FHWA initiated the 20/10 program. This program set a national goal of reducing the number of fatal crashes and serious injuries by 20 percent over 10 years. While the rate of fatal crashes and serious injuries were declining, the aggregate number of such crashes was still increasing, with the average number of yearly fatalities on our U.S. roads at around 42,000. FHWA's goal was to bring the "numbers" down.

The FHWA encouraged each state to adopt similar goals, which were quickly embraced by New York State's Governor's Traffic Safety Committee (GTSC), which includes the State Police and the New York State Department of Transportation. In August 1999 the FHWA briefed members of the GTSC using a statistical analysis to show that pedestrians in New York State comprise 25 percent of reported fatalities and serious injuries compared to 12 percent nationally. This convinced GTSC members in January 2000 to make pedestrian safety the subject of a high-impact initiative to address the 20/10 goal. In February 2001 Governor George Pataki requested, in a letter sent to all safety advocates, that they concentrate on several areas of safety, including pedestrian safety, identified by the GTSC in order to be eligible for highway safety funds.

The Approach: The Domestic Pedestrian Scanning Tour

In November 2002 the FHWA, GTSC, and the Institute for Traffic Management and Research (ITSMR) joined forces to propose that a group be formed to tour U.S. cities to understand state-of-the-practice safety programs and projects that could better inform New York officials on the best means to improve pedestrian safety. Research identified a number of cities with innovative safety projects or programs. From this list the team chose cities that had winter weather conditions, such as freezing rain, snow, and ice, similar to that of New York. Cities selected on this basis ranging in size from village/small city to large urban area included: Portland, Maine; Durham, New Hampshire; Cambridge, Massachusetts; Seattle, Washington; and Portland, Oregon. New York City was added to the tour as a model for its use of quantifiable before-and-after crash statistics to evaluate the success of pedestrian safety initiatives.

In October 2003 a multi-disciplinary team of professional planners, engineers, and safety and enforcement experts was selected to participate in the tour on the basis of their proven ability to affect change within their respective constituencies. The group represented localities from throughout New York State to ensure the broad dissemination of useful information about effective safety programs. In November 2003 the team visited the host cities in two separate week-long trips. Day-long presentations and briefings by, and discussions with, local transportation officials, supplemented by a wealth of written material, were followed by site visits to see physical and operational street, sidewalk, and signing improvements.

This document, in sections on enactment, engineering, education, enforcement, and economics, seeks to describe the improvements the team saw and recommend the consideration of those policies and programs that demonstrably improve pedestrian safety to those decision makers across New York State. Once intersection and mid-block crossings are intelligently engineered and installed, education and enforcement become key elements toward effecting reductions in pedestrian fatalities. Although the latter is often regarded as costly, if deployed properly these two areas require little maintenance and can sometimes be significantly more economical than many engineering solutions. Every effort should be made to implement them whenever practicable. Unlike engineering improvements, education and enforcement target behavioral changes. Both should be considered as long-term investments toward changing what is

sometimes considered to be “socially acceptable” violations of the law, or perhaps recognized as violations that have not been aggressively scrutinized in the past. An added bonus is that once these behavioral changes are effected, they require significantly less effort to maintain as this behavior now becomes part of an individual’s routine and often is emulated by others.

The hospitality of our host cities cannot be overstated, nor can the obvious expertise, knowledge, and dedication of city, state, and federal officials we met in each city. The preparation and effort they exhibited in ensuring that our visit was interesting, informative, and productive will pay high dividends in improved safety for pedestrians in New York. Any failure to convey through this report’s recommendations the enormous benefits conferred by these pedestrian safety plans and programs may be attributed solely to its authors.

ENACTMENT

Legislation and Regulation

Many of the cities and states the team visited have enacted legislation, ordinances and policies to better accommodate, encourage, and ensure the safety of pedestrians. This section of the report describes laws that govern the funding of pedestrian projects, growth and travel demand management, traffic calming, and other regulatory mechanisms, such as zoning, that may be used to promote pedestrian safety.

Funding

Federal transportation legislation has been instrumental in advancing pedestrian projects. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and its successor, the Transportation Equity Act for the 21st Century (TEA-21), for the first time allowed federal highway transportation funds to be used to plan, design, and build non-motorized transportation improvements.

Both Massachusetts and Oregon reserve portions of their transportation funds for pedestrian and bicycle projects. Massachusetts law requires the reasonable accommodation of pedestrians and cyclists in all state road projects. The 1994 Massachusetts Transportation Bond Bill makes reasonable accommodation for pedestrians a condition for funding projects. Oregon's statutes mandate that "of State Highway Fund[s] reasonable amounts shall be expended... to provide footpaths and bicycle trails, curb cuts or ramps..." Cities and counties that receive state highway funds greater than \$25,000 and \$150,000, respectively, must by law use at least one [1] percent of these funds for pedestrian and bicycle projects. The governing body of metropolitan Portland mandates pedestrian improvements, including the Metro street design guidelines, throughout the region's five counties. Portland, Oregon requires the construction of new or improved sidewalks in almost all street construction projects and as part of the development of new buildings (*Portland Pedestrian Design Guide*). Since 2000, street construction projects must meet the design guidelines articulated in the report *Creating Livable Streets* in order to receive funding.

Traffic Regulations

Standard traffic and pedestrian laws have not always been explicitly tied to pedestrian safety. The states visited all had similar laws governing speed and regulating the interaction of vehicles and pedestrians. Motorists are required to obey posted speed limits, to stop for pedestrians in crosswalks, on sidewalks, and at intersections, and to exercise due care. Pedestrians must obey traffic signals, must not bolt into traffic, and must yield to vehicles outside of intersections (in some cities pedestrians are not allowed to cross outside of intersections).

Seattle; Portland, Oregon and Cambridge have legislation that is more pedestrian-safety oriented. In Seattle vehicles approaching a crosswalk must slow or stop if a pedestrian is in their half of the roadway; in Portland it is illegal for a vehicle approaching a crosswalk to pass another vehicle stopped at that crosswalk. In Cambridge pedestrians and vehicles are given equal treatment with respect to capacity, level of service, and accommodation/occupancy of space.

Since January 19, 2003, drivers in New York State have been required to yield to pedestrians walking in a crosswalk in both halves of the street where a traffic signal is not present or not operating. Formerly, the law only required drivers to yield to pedestrians in their half of the crosswalk.

Close to half of the fifty states currently have similar laws on the books. New regulatory signs have been installed at intersections and crosswalks statewide to educate motorists and pedestrians about the revised law.

New York State has also passed legislation permitting New York City to use 50 red-light cameras to document violations and issue tickets. The success of the program is summarized in the chart below. Notice how public information and education decreased the number of red-light-runners. While the number of intersections equipped with red-light cameras increased, there was a downward trend in the number of violations per camera-equipped intersection.

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002
# of Cameras	15	18	18	30	30	30	30	50	50
Red Light Runners (thousands)	439	382	320	258	418	392	414	453	247

Growth Management

Land use and growth management laws and strategies can provide the framework for pedestrian safety programs through mandated transportation plans. Most regions have adopted such policies. In order to receive transportation funds, regions must have a multi-county planning body that examines and plans for growth management and land use.

The State of Oregon, specifically the Portland area, has been at the forefront of land use and growth management laws for the last 25 years. Growth management in the Portland Metro area is governed by the *2040 Growth Concept*, a binding plan adopted in 1995 in response to rapid population growth and quality-of-life concerns. The *2040 Growth Concept* directs most development to population centers and along major transportation corridors, and its transportation component outlines a system “that accommodates walking, bicycling, driving, using transit and keeping freight moving.” Subsequent plans that are binding under the *2040 Growth Concept* include: *Getting There: Metro’s Regional Transportation Plan*, the *Portland Pedestrian Master Plan*, and the *Portland Pedestrian Design Guide*. Metro’s *Green Streets* guides serve as a threshold for all regional transportation funding.

In 1990 the State of Washington passed the Growth Management Act (GMA), which requires officials in fast-growing, densely-populated areas to develop and adopt binding local, county, and/or multi-county comprehensive plans that include a consistent transportation element. The multi-county plan for the Central Puget Sound Region, *Vision 2020*, and its transportation component, *Destination 2030*, outlines a strategy “designed to ensure that development in our communities makes it easier to walk, bicycle and use transit.” The plans recommend connecting the areas where residents live, work and recreate; creating an urban environment amenable to non-motorized travel; using transportation investments to support transit and pedestrian-oriented land use patterns; and managing travel demand. Actions taken under *Vision 2020* and *Destination 2030* are monitored by the Puget Sound Regional Council.

The City of Seattle’s *Comprehensive Plan: Transportation Element* mandates policies to reduce SOV (single-occupancy vehicles) commuting through incentives and penalties; foster public involvement, site-appropriate transportation facilities, and multi-modal transit centers; increase, integrate, and maintain bike and pedestrian facilities; and recognize the importance of walking to the city. The plan specifically recommends that all street improvement or construction projects maintain or enhance pedestrian facilities, and that physical traffic calming measures are implemented.

The 1995 document, *Accessing the Future: The Intermodal Transportation Policy Plan for the Commonwealth of Massachusetts*, adopts a statewide policy to support and promote safe walking in the commonwealth, to convene a Pedestrian Planning Advisory Board (since done), to regard pedestrian safety as primary in the planning, design and construction of transportation facilities, to encourage viable alternative modes of transportation, and to reduce air pollution.

The *City of Cambridge Climate Protection Plan* promotes reduced vehicular traffic and the improvement of pedestrian facilities. The *Massachusetts Pedestrian Transportation Plan* and the *Cambridge Pedestrian Plan* are nonbinding, but both serve as excellent resources for

pedestrian planning. The *Regional Transportation Plan (RTP) 2004-2025 of the Boston Region MPO*, a binding document, discusses the willingness of the Metropolitan Boston Transit Authority's (MBTA) to make rights-of-way available for bike and pedestrian trails and to add bike facilities to all MBTA stations upon reconstruction.

Travel Demand Management

Trip reduction ordinances improve pedestrian safety by taking vehicles off the street and thereby minimizing the potential for conflict. The State of Washington passed its Commute Trip Reduction Law in 1991 as part of its Clean Air Act. The law requires major employers to develop programs to reduce vehicle trips. The programs are evaluated every two years; if they do not produce the desired trip reductions, the state can mandate changes to employers' programs, and fine employers if they refuse to set up or modify their programs.

Cambridge's 1992 Vehicle Trip Reduction Ordinance mandates bike and pedestrian programs and other measures to reduce motor vehicle travel. In 1998 Cambridge passed a Parking and Transportation Demand Management Ordinance, which requires developers seeking to build or expand parking facilities to take actions to reduce by 10 percent (from 1990 levels) the number of trips made to the site by car. The city must approve the plan and a compliance officer monitors the firm's progress in meeting its stated goals.

Maine's Sensible Transportation Policy Act calls for travel demand management. Portland's *Comprehensive Plan* calls for the incorporation of travel demand management into ordinances that govern the review of projects within the city.

Zoning and Other Non-Legislative Controls

Zoning and land-use controls provide another legally-binding means to promote safe walking. Zoning may limit parking, maximize density, or permit mixed-use development in order to discourage sprawl and dependence on the automobile. Street wall provisions may encourage the design of a pedestrian-friendly environment conducive to walking. A street wall requirement mandates that a building be built to the property line or some uniform distance setback from the property line. The requirement seeks to ensure the continuity of the relationship between the sidewalk and the buildings.

In Cambridge all developers must meet all city-mandated, transit-related requirements (such as SOV trip reductions previously described) in order for projects over 50,000 square feet to be considered and approved. Seattle uses zoning in two innovative ways to encourage pedestrian facilities. The first is the concept of the urban village, which is characterized by mixed-use residential and commercial development, existing high levels of transit service, a broad range of housing types, access to open space, and opportunities for redevelopment. The Seattle zoning code permits pedestrian zones when "private development relates to the street with the intention

of making the street front as pedestrian friendly as possible.” The designation requires ground-floor commercial use, reduced parking requirements, and prohibits drive-in/through businesses and parking fronting the pedestrian street.

Portland, Oregon designates pedestrian districts in the Transportation Element of its Comprehensive Plan. The Oregon State Department of Transportation (ODOT) formally defines as Special Transportation Areas (STA), state highways that serve as a town’s main street. STAs, as described in *Main Street... When a Highway Runs Through It: A Handbook for Oregon Communities*, allow ODOT to apply different engineering standards in order to balance the need to move through traffic with local access and circulation needs.

Traffic Calming

Portland, Maine and Seattle, Washington have traffic calming ordinances, both of which rely heavily on community input. Community members in Portland may petition, or any city council member may request, that the city’s traffic engineer study a street to see if it is eligible for traffic calming. Though the determination of eligibility lies with the traffic engineer, the law gives the local community means to initiate the adoption of traffic calming techniques and strategies on their streets.

When implemented without that input, projects are less likely to succeed, as discovered in Portland when traffic calming measures were installed without community approval and subsequently removed under community pressure.

Washington State’s Neighborhood Traffic Safety Program works with neighborhood groups and the Kings County Sheriff to address traffic and pedestrian safety issues. Improvements such as traffic calming measures are developed and implemented upon the consensus among neighborhood residents that such an improvement is desired. Since 1978 SEATRAN (Seattle) has built residential traffic circles when requested by the local community.



Traffic Calming Project with Mini Roundabouts in Washington

Neighborhood support for the proposal is guaranteed by requiring a petition with signatures representing at least 60 percent of the households within a block of the proposed circle. The circles are very popular: SEATLAN receives approximately 700 requests for circles each year, though it has funding to construct only 30.



Traffic Calming Project with Serpentine Street in Washington

Cambridge, Massachusetts has adopted an effective traffic calming policy that relies on local input and is complimented by other city programs.

Transportation professionals agree that traffic calming measures reduce the vehicle speeds and volumes that ostensibly reduce the severity and frequency of pedestrian crashes. However, some transportation professionals are still debating the merits of other devices such as the modern roundabout and it's affect on pedestrian safety, especially for visually impaired pedestrians, and whether they can be made safe with slight modifications such as pedestrian signals and other design changes.

Agency Involvement

Agency policies and directives are an effective method of enacting pedestrian improvements. Implementation and oversight must be endorsed by and embedded in local administration in order to be effective. Transportation and public works agency directors, engineers, and planners must believe in pedestrian safety measures and be empowered to implement and enforce them.

Examples of policies that affect infrastructure are found in all six cities visited. Cambridge is committed to using zebra-striped crosswalks rather than parallel crosswalks due to the greater visibility that they provide, phasing out pedestrian-activated buttons, and considering leading pedestrian intervals (*Cambridge Pedestrian Plan*).

King County's (WA) safety and mobility program uses their Engineering and Public Works Department to fill the missing links in sidewalks, curbs, and gutters at spots identified by the traffic engineering section of DOT. Improvements include innovative treatments such as in-pavement flashers. Using the other two legs of the 3 E approach (engineering, enforcement and education), SEATRAN's Neighborhood Speed Watch has concerned citizens measure and record speeds and speeding vehicles' license plates for three days, then uses enforcement and education to target those scofflaws.

MassHighway's Pedestrian Program Office issued an engineering directive that mandates that project design engineers make reasonable accommodations for pedestrians, including a smooth and continuous path of travel without obstruction on all roadways where pedestrian travel is legal (*Massachusetts Pedestrian Transportation Plan*).

ENGINEERING

Unlike other measures discussed in this report, engineering improvements are limited to specific sites with clear project limits. However, few actions have a bigger impact on safety *within those limits* than well-designed and targeted physical and operational improvements. One of the most important elements found in the model cities is applying engineered safety improvements to large parts of their road networks. This chapter will discuss what they do to affect pedestrian safety - road planning, design, construction, traffic control, and maintenance - and how they did it. The team will analyze the lessons they learned, and cite a range of traffic control devices, traffic calming devices, signs, and markings that could be used in the State of New York.

It is important to distinguish between *perceived* safety, *normative* safety, and *substantive* safety. Perceived safety refers to how comfortable people feel using a facility: it is a subjective assessment of risk, and may or may not correlate with normative or substantive safety. Normative safety means it meets applicable design standards, whether it is actually operating safely or not. Substantive safety describes how many crashes are actually occurring at a given location, and whether or not it is safer than average for similar facilities.

Our host cities did not use this terminology, but expressed a strong desire to improve substantive safety and perceived safety while demonstrating the willingness to go beyond the minimum normative safety. Traffic engineers will often trade off perceived safety for improved substantive safety. It is important to note that while the objective of this scanning tour was to strictly look at pedestrian safety, efforts that improved health and the environment could not be ignored.

Traffic Safety Studies

The foundation of any safety improvement program is identifying and understanding the safety problems to be solved. This is the role of the traffic safety study. Pedestrian traffic safety studies include investigations of pedestrian high accident locations, crosswalk safety studies, and safe route to school surveys, among others.

Prioritization

Few transportation agencies have the resources to answer every complaint or request for study immediately. Prioritization is essential. For instance, the Oregon Department of Transportation gives high priority to traffic studies that address red-light-running, speeding, and pedestrian or bicyclist safety, or safe routes to schools. While not strictly related to pedestrian safety, reducing red-light-running and speeding can reduce the risk of serious or fatal pedestrian crashes, especially in urban or suburban areas.

Data Gathering

The success of any traffic safety study rests on the quality of the information used. Pedestrian crashes are notoriously underreported. Several things can be done to improve data quality. Seattle uses hospital records to supplement DMV accident reports and thereby pick up pedestrian and bicyclist crashes not reported to the police or Department of Motor Vehicles. Durham, New Hampshire uses a supplementary accident form for pedestrian crashes. Portland, Oregon uses a geographic information system (GIS) to locate crash locations and complaints on the same map.

Crosswalk Inventories

Several cities, notably Seattle, cited a 2000 study by Charles Zegeer, et al., on the effects on pedestrian safety of marked crosswalks at uncontrolled locations where pedestrians cross motor vehicle traffic without benefit of a stop sign or traffic signal.

The study found that marked crosswalks do not improve the safety of pedestrians unless they are combined with signs, traffic calming measures, or other devices. Marked crosswalks were found to actually increase pedestrian risk when traffic volumes exceeded 10,000 vehicles per day. Additional measures are needed to improve safety, such as warning signs, raised crosswalks, or median pedestrian refuges.

Seattle inventoried conditions at 856 crosswalks where motor vehicle traffic was not controlled by a stop sign or signal. Of these, 622 crossed arterials and 234 crossed residential streets. Each crosswalk was rated as compliant, non-compliant, or possibly non-compliant, based on whether it met the recommendations in the Zegeer study. These are based on daily traffic volume, traffic speed, and number of lanes. Eighty-five percent of the crosswalks were compliant, while the non-compliant (10 percent) and possibly noncompliant (5 percent) crosswalks tended to occur along corridors. They also found that almost all crosswalks could benefit from some improvements. (For more information on the Zegeer study and Seattle's crosswalk survey, see the Recommended Reading List at the end of this document.)

Road Safety and Walkability Audits

Road Safety Audits (RSAs) are formal examinations of an existing or future road by an independent team of trained specialists. The RSA team assesses the crash potential and safety performance of a roadway project and prepares a report that identifies potential safety problems. They are proactive, seeking out problems, rather than reacting to complaints or crashes. Portland, Maine conducts walkability audits, a specialized form of road safety audit that look specifically at pedestrian safety and access issues.

Given that the Access Board is developing new regulations to address right-of-way access issues, walkability audits should be promoted to actively identify accessibility problems rather than awaiting complaints or lawsuits.

Safe Routes to School Studies

Several cities have safe routes to school programs, which determine and mark the best routes for children to walk to school, considering the age of children, motor vehicle traffic patterns, and sidewalk conditions. These programs involve school administrators and parents, as well as public works officials. More police involvement would increase the effectiveness of these studies. The approach to traffic safety exemplified by these programs – proactive, logical analysis based on sound research – should be used more in New York State.

Project Planning

Like almost all New York municipalities, the cities that were visited do not have enough resources to address all the problems they face. Good planning is essential to making the best use of taxpayers' money and limited resources. These cities have chosen to make pedestrian safety a high priority.

Seize Opportunities as They Arise

It is easy to be overwhelmed by the amount of work needed to make your community a walkable one. The key is breaking it into manageable tasks. (How do you eat an elephant?...one bite at a time!) There is an important advantage to this: elected officials like bite-size projects that can be accomplished before the next election. This will help get their support.

Municipalities should take advantage of chances to include pedestrian safety improvements as part of other construction work whenever possible. Cambridge requires pedestrian improvements whenever a sidewalk is disturbed by utility work, drainage repairs and improvements, or by developers under highway work permits. Combining necessary drainage work with the installation of traffic-calming measures such as raised crosswalks and curb extensions makes sense, since these measures often affect drainage. Oregon DOT conducts Sidewalk with Preservation (SWIP) projects, which adds sidewalk construction to highway resurfacing projects.

Involve the Public

If you are departing from business as usual, public support is essential.

Portland, Maine discovered this the hard way. They implemented a comprehensive package of speed tables, lateral shifts and curb extensions on a road connecting several schools and colleges. The outcry of the populace forced them to remove many of the measures, leaving only the speed tables. As noted, the city revised its traffic-calming ordinance to require that local residents initiate and support requests for such improvements.

In a similar fashion, New York experimented with in-pavement lighting at Marist College in Poughkeepsie. In addition to some teething problems from the then-new technology, the project was unsuccessful largely because of the lack of public information and education prior to its installation. Consequently, the in-pavement lights were removed, leaving some observers to question the merits of the product rather than to acknowledge flaws in the implementation. Cambridge, Massachusetts has successfully installed in-pavement lights very similar to those placed at Marist College along a high-volume pedestrian corridor. The major difference is that a public campaign to inform and educate citizens and to enforce the new rules preceded and accompanied the implementation of the in-pavement devices at MIT.

Question Your Priorities

Municipalities may benefit from objectively looking at their priorities and the assumptions on which they are based to make sure they still match the changing needs of the community and promote its future health and growth.

In 1984 Seattle officials reevaluated their priorities and concluded that they could no longer keep up with demand for motor vehicle capacity. They focused instead on managing motor vehicle delay rather than eliminating it. This allowed them to shift funding to traffic safety, transit, and pedestrian-oriented improvements. It should be noted that Seattle is one of the very few large cities that decreased travel delays from 1992 to 2002, based on a recent Texas Transportation Institute study.

Pedestrian Project Design

Engineers in the United States have been accused, with some justification, of favoring motor vehicles over other road users regardless of their volumes, trip generations, etc. This is changing, and advocates can speed this change by informing their elected officials and highway departments that they support improved non-motorized transportation. Our host cities successfully balance design considerations for all users.

Here are some of our key findings:

Good design promotes good behavior. Many of the agencies the team talked to have adopted this philosophy in roadway design. Rather than taking driver, cyclist, and pedestrian behavior as a given and trying to design for it, they use the design of the road and its surroundings to try to influence behavior in a positive way.

Traffic calming techniques can work in northern climates. The team observed many applications of raised intersections and crosswalks in Portland, Maine and curb extensions in Cambridge and Durham. Portland, Oregon reports that they have reduced vehicle operating speeds by as much as 28 percent using traffic calming. However, not all locations are appropriate for traffic calming. Portland, Maine reported problems with the installation of speed humps and

emergency vehicles. (Speed humps should be long enough so that both axles of a fire truck are simultaneously on the hump.) As a result, they will not install speed humps on major ambulance routes.



Raised Speed Table, Portland ME

Street design standards can encourage slower speeds while still accommodating emergency and maintenance vehicles. Neighborhood streets should be narrow enough to discourage speeding. Excess roadway should be recaptured to accommodate pedestrian circulation and reduce impervious area and cost. One method of doing this is discussed below under "Road Diets."

Roadside clear zone standards were viewed as unnecessary or even counterproductive for low-speed pedestrian-oriented roadways. Street trees and amenities encourage drivers to drive slower, and some say this more than offsets the increase in run-off-road crashes. This assertion is currently being researched under a National Cooperative Highway Research Program grant. Results are due by the end of 2005.

The best designs consider maintenance. Safety devices do not work as intended if they cannot be maintained, and poorly maintained facilities are not inviting to pedestrians.

Geometry

Geometry, or geometric design, refers to the layout of the road, including the radius of intersection corners, lane width, and sidewalk placement. It has a profound impact on the behavior of people using the road. For example, if you want to control speeding on a residential street, don't design it to look like an arterial. The design of many geometric features inherently involves tradeoffs.

Intersection Curb Radius

Intersection curb radius is an excellent example of these tradeoffs. Trucks need larger radii to turn at an intersection without encroaching on the oncoming lane. Larger radii have also been shown to reduce rear-end crashes for right-turning vehicles. Large curb radii also increase the distance it takes the pedestrian to cross the intersection and permits traffic to turn at a higher speed, both of which increase the probability and severity of pedestrian crashes.

The cities the team visited have chosen to favor the pedestrian in this tradeoff. The City of Seattle uses much tighter minimum radii than recommended by AASHTO, including at arterial intersections. It is acceptable to them for heavy vehicles to encroach on the oncoming lane to make the turn.

However, if the corner radius is too small, it can pose safety problems for pedestrians. The team witnessed a school bus driver who chose to mount the curb rather than enter the oncoming lane. This dilemma can be avoided: the stop bar on the intersecting street should be moved back so that trucks and buses can use the full width of the street to make the turn. This works best at signalized intersections, where sight distance is not as critical.

Curb radii in the range of 7½ meters to 9 meters facilitates vehicle turning movements, while reducing speed of turning vehicles and reducing crossing distances for pedestrians. In particular, the curb radius should be large enough for emergency responders (fire trucks), school buses, and maintenance vehicles, including snow plow trucks and street sweepers. With modern computer-aided design (CAD) it is easy to design and build three-centered curves that better conform to the path vehicles need to follow, while narrowing crossing distances.



Tight Curb Radii, Seattle WA

Sidewalks

Sidewalks are essential for safe walking. Sidewalks should be a minimum of five feet wide to comply with the Americans with Disabilities Act Accessibility Guidelines and to promote social walkability. It should be noted that the effective width of the sidewalk is less than its actual sidewalk width when buildings or walls are immediately next to the sidewalk. In Portland, Maine road designers are required to include sidewalks in every project, unless they can justify their omission based on lack of logical endpoints for the sidewalk.

Where decorative pavers or brick sidewalks are used, Cambridge requires a minimum four inch thick concrete base under the stone dust and brick pavers and a six inch thick concrete base at driveway entrances. It should be noted; however, that decorative pavers and bricks make it very uncomfortable for pedestrians in wheelchairs, and use of them is not a recommended practice. Localities wishing to add a decorative element to their walkways should consider using concrete sidewalks with brick edgings instead, or stamped colored concrete. Residents are responsible for clearing sidewalks of debris, snow, and ice. When rehabilitation or reconstruction is warranted, the surface must match the surface that was there before construction.

Buffers

A grass buffer or amenity strip between the curb and sidewalk has many benefits. When sidewalks are set back from the street, drivers have more time to react should a walker turn and cross the street. Recent research in Florida suggests that increasing the distance between the pedestrian and vehicular traffic increases pedestrians' *perceived* safety (the effects on *substantive* safety were not evaluated). The buffer between the street and sidewalk also keeps pedestrians out of range of splash and spray kicked up by vehicles on rainy days.

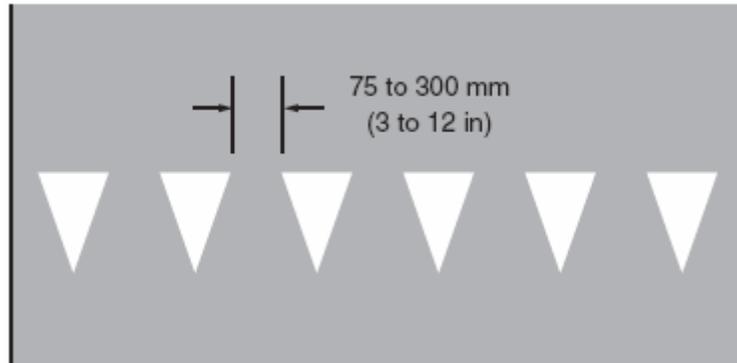
Portland, Maine noted the value of buffers as snow storage areas, permitting sidewalks to remain clear of snow plowed off of the traveled lanes.

In retail areas Seattle requires four-foot buffers between the sidewalks and parking lots, as well as between the sidewalk and the street.

Multiple Lane Roads

Multiple lane roads with four or more travel lanes present pedestrians with a special type of problem. The multiple threat occurs at mid-block or uncontrolled crosswalks when a vehicle in the first lane yields to a pedestrian, but blocks the view of the pedestrian to a driver in the adjacent lane. The driver of the second vehicle passes the first and hits the pedestrian as he or she steps out past the first vehicle.

Maine DOT reported they use advance yield-to-pedestrian markings, or white triangular "shark teeth," as shown in Figure 3 taken from the MUTCD. They are placed in 10 m (30 feet) in advance of a mid-block crosswalk on multilane roads.



Yield Line Pavement Markings

Pedestrian-vehicular conflicts at midblock were reduced by 74 percent in Nova Scotia, Canada after the markings were installed. The number of vehicles yielding to pedestrians in the crosswalk increased slightly.

Road Diets

Urban and suburban undivided four lane arterials often carry less traffic than their maximum capacity. Speeding is common, and vehicles waiting to turn left often block left lane traffic. This reduces the capacity of the road and often results in high crash rates. Road diets are projects that reassign unneeded road width to other uses. Often four lane undivided arterial roads may be reduced to two or three lanes without affecting traffic flow, and the remaining width may be reconfigured for use as bicycle lanes, parking lanes, and/or wider sidewalks.



Road Diet, Portland ME
A four-lane undivided roadway (in background) was restriped as a three-lane road with a flush turn lane (in foreground).

Seattle has built 17 road diet projects. Before-and-after studies showed that crash rates for pedestrians and mid-block left turns have been reduced, very little traffic diverted to parallel roads and motor vehicle delay did not increase. Sometimes additional turning lanes are needed at intersections to handle vehicle traffic volumes.

Medians

Medians are used on multilane arterials to provide a refuge for pedestrians. This allows them to cross the road in two stages, increasing the number of usable gaps in traffic. Pedestrian ramps flush with the street bisect the medians to avoid causing problems for handicapped users. Flexible delineators are used to discourage motorists from cutting through the median.

Travel Lane and Shoulder Widths

The cities the team visited often mark travel lane widths at less than the AASHTO norm of 12 feet. Ten and eleven foot wide lanes were common, with some lanes as narrow as 9.5 feet. In the Durham, New Hampshire area, 11 feet is the regional standard as approved by the city's fire chief and New Hampshire DOT's Regional District Engineer.

The reduced lane width helps to shorten the crossing distance for pedestrians or allows wider sidewalks or bike lanes. It also functions to slow traffic. Research on rural two-lane roads shows that the difference in crash rates between 11- and 12-foot lanes is small. Similar research

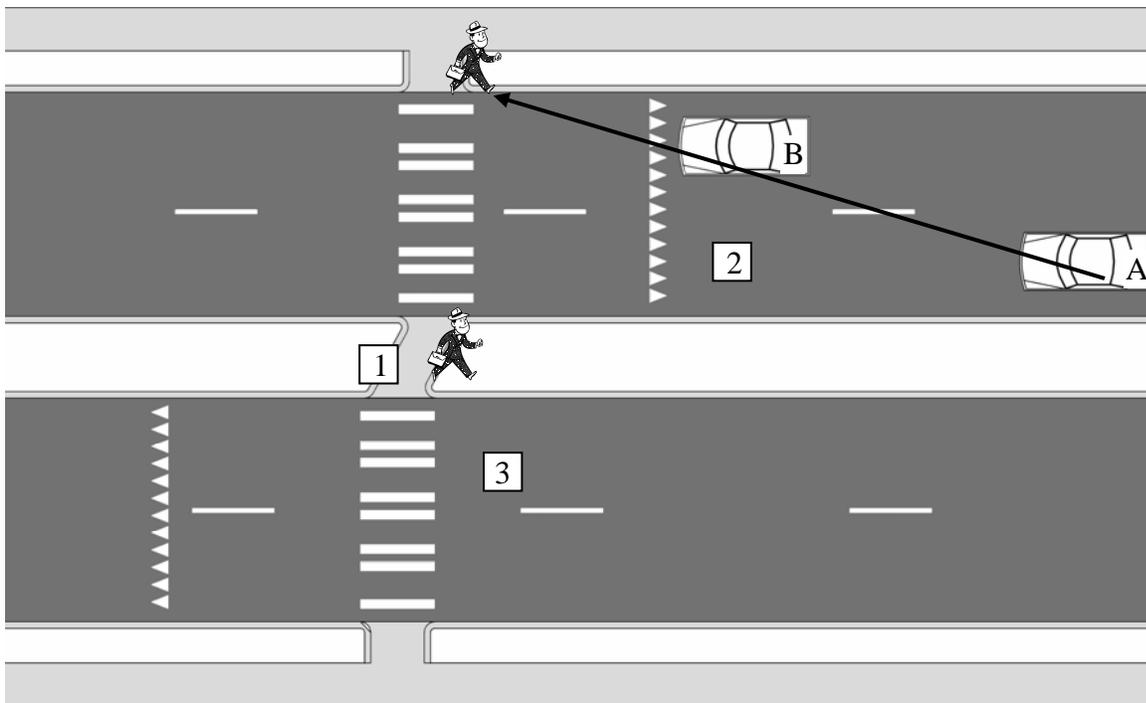
is currently being conducted on multilane roads and lower speed urban roads. If similar results are found, the benefits to pedestrians of eleven foot lanes could exceed any safety costs to motorists.

In Durham the University of New Hampshire provides a minimum of four-foot shoulders on each side of each road for use as bike lanes.

Portland, Maine uses eight-foot shoulders. Half of this width is paved, and the remaining four feet is crushed stone to reduce its use as a travel lane. Maine DOT uses two-to-eight-foot shoulders depending on traffic volumes. With eight-foot shoulders, Maine DOT uses four feet of stabilized base with four feet of loam and seed in order to avoid edge drop-offs for bypassing vehicles.

Crosswalks

Consistency of crosswalk markings is an issue (traditional === vs. ///// zebra striped). Zebra or “piano key” markings last longer than traditional parallel lines because they can be spaced between vehicle wheel paths, so markings last longer. Advance yield lines encourage vehicles to stop for pedestrians farther from the crosswalk. This lets the driver in vehicle A see around vehicle B, which has already stopped for a pedestrian.



Median with skewed pedestrian crossing:

1. Angled cut-through encourages pedestrians to look toward traffic.

2. Advance yield lines encourage vehicles to stop for pedestrians further from the crosswalk. This lets the driver in vehicle A see the around vehicle B, which has already stopped for a pedestrian.
3. "Piano key" crosswalks place the markings in between wheel paths so markings last longer.

Some cities used a textured colorized pavement treatment for crosswalks. However, this should be considered an aesthetic treatment and has no safety benefit to pedestrians because it does not increase the conspicuity of the crosswalk to drivers. Textured pavements may impede wheelchair users and other pedestrians with mobility problems, and color coatings may be slippery when wet.

In-Road Flashing Beacons

Maine DOT and Cambridge, Massachusetts are both using in-pavement flashing warning lights at crosswalks with high pedestrian volumes. These have been shown to reduce conflicts between pedestrians and vehicles, and the technology is maturing rapidly.



In-Pavement Flashing Pedestrian Warning Lights, Cambridge MA

Signs

In our travels the team saw several variants of overhead crosswalk signs like the one shown in below.



Overhead Sign, Seattle WA

Overhead signs have increased visibility, especially with older drivers, and serve to pinpoint the location of the crosswalk and provide advance warning. Some were retro-reflective, others were internally illuminated. Signs – whether overhead or ground-mounted – can be enhanced with flashing beacons, which can flash continuously or be triggered by pedestrians. Maine uses overhead pedestrian crossing signs with pushbutton-actuated beacons and traffic signals to command attention.

Maine DOT specifies microprismatic retro-reflective material for their fluorescent yellow-green signs. This color is optional for pedestrian, bicyclist, and school-related signs. NYSDOT is implementing a similar policy, and municipalities should be encouraged to follow suit.

Our hosts were unanimous in their condemnation of Children at Play signs, which have little or no effect on drivers' actions or the safety of children.

Signal Timing and Phasing

Cambridge sets the timing of its traffic signals so that all phases are long enough for pedestrians to cross the road, even if that increases delay for vehicles. The timing is based on allowing the first pedestrian, as well as the last pedestrian, in the queue to clear the intersection during the pedestrian phase based on historic pedestrian counts at that intersection. A preset pedestrian

phase is incorporated into each signal cycle, making pedestrian-actuated push buttons unnecessary. City officials felt that timing plans designed to maximize vehicular capacity are often dangerous to pedestrians, and they are willing to delay vehicle traffic to aid safety and walkability.

Pedestrian signal phases that are concurrent with traffic have not been shown to make pedestrians safer. To address this Cambridge is adding leading pedestrian intervals (LPIs) to its signal timing policy. In a leading pedestrian interval the WALK sign begins three to five seconds before the green light for traffic, allowing pedestrians to establish a position in the crosswalk prior to turning cars. An all-pedestrian phase minimizes pedestrian vehicle conflict at the expense of vehicle delay. LPI's have also been used in a few locations around New York State with great success.

Oregon DOT requires all counties to have a Transit Signal Priority (TSP) Plan and adjust their development codes to reflect the plan. Transit signal priority reduces delay for transit buses. During any significant development, new signals within the TSP corridor must be coordinated or timed to reduce delay for transit buses, thereby decreasing travel time for transit riders. The goal is to encourage people to use transit or walk, rather than utilize single-occupancy vehicles.

Several cities prohibit right turns on red during times of peak pedestrian flow such as school hours. Some prohibit right turns on red at all times along major school routes.

Signal Hardware

Our hosts in Maine expressed an opinion also echoed around the country that pedestrians do not understand the meaning of the flashing "don't walk" phase. As in some places in New York, Maine is using countdown signals to help pedestrians understand when to walk and how much time is remaining to cross the street.

Seattle uses "half signals" to help pedestrians cross arterials while discouraging cut through traffic. A half signal is a pedestrian signal at a stop-controlled intersection that permits pedestrians to push the signal button to stop traffic on the main road.

Several cities employ accessible pedestrian signals, which use sound cues and raised Braille or pictogram signs to aid blind pedestrians. Maine DOT, in developing guidelines for their use, has chosen to use spoken word messages instead of "cuckoos" and "chirps," which have been mistaken for real birds.

Maintenance

The best improvement is ineffective if it isn't properly maintained. Our host cities have some interesting and innovative maintenance techniques worth sharing.

Portland, Maine prioritizes the replacement of pavement markings; school zone crossings are done first, then intersection markings, including crosswalks, and long lines (edge lines and centerlines) are striped last.

Snow and ice control is a major problem for pedestrians in northern cities. Winter weather makes walking less pleasant, more difficult, and increases the risk of slips and falls. Additionally, if sidewalks are not cleared pedestrians often walk in the roadway. Snow banks make pedestrians harder to see at intersections and driveways. Several cities have programs where shoveling snow for the elderly or handicapped counts toward court-ordered community service.

Cambridge has a public works crew dedicated to clearing snow from bike and pedestrian access points and major bus stops. The city also trains its snowplow drivers to familiarize them with traffic-calming measures.

While property owners shovel most sidewalks, Portland, Maine has a dedicated crew/staff which plows about 70 miles of sidewalks, mostly on walk-to-school routes. The city reports no problems plowing their raised intersections and crosswalks, but does have problems with street plows piling snow onto sidewalks where residents and the sidewalk plows must deal with it. Buffers or "promenades" in Down East dialect, provide snow storage space between the road and sidewalk.

Portland, Oregon has adapted the Adopt-a-Highway idea to transit. Businesses or individuals that participate in the Adopt-a-Stop program receive a free bus pass for cleaning and removing garbage from the bus stop shelter.

Road Work

Many work zones do not maintain accessible pedestrian routes during construction. Cambridge requires a work permit from any entity excavating on sidewalk, including homeowners and state and city agencies. The traffic control plan must include pedestrian safety and access during construction. A pedestrian facility is required on the same side of the road as the closed sidewalk; pedestrian detours are rarely allowed. Sidewalk sheds with lighting are preferred, but contractors may use temporary concrete barriers in the parking lane to separate the walkway from traffic. A stable, firm, and slip-resistant surface must be provided at all times.

Conclusion

Many of the lessons learned can be applied in New York. Some of the more important ones include:

- Proactively look for pedestrian safety and accessibility problems, rather than waiting for complaints or crashes.
- Seek and seize opportunities to make improvements whenever possible. These include highway construction and maintenance and highway work permits.
- Reach out to stakeholders during project development, including nearby residents and businesses, as well as school districts. Projects are more likely to succeed with their support.
- Make pedestrian safety and access an integral part of the project planning and design process, unless they are not needed due to the nature of the project.

EDUCATION

Educational efforts can have great benefits on improving pedestrian safety for children who are statistically more at risk than other age cohorts, and for adults. Each of our host cities devoted much of its attention to developing innovative programs to encourage children to walk for health and environmental reasons. They then provided the children with the tools and routes by which to safely walk to school and other destinations in their communities.

Walk to School Programs

Safe Routes to School

This increasingly popular program is designed to increase the number of children walking and bicycling to school while reducing vehicular traffic. Safe Routes to School addresses health and safety issues for children while improving the overall environment for everyone. Safe Routes to Schools encourages walking by improving safety. The reduction in motor vehicle trips enhances the air quality; improves children's health through increased activity, allows children greater access to after and before school activities by reducing their reliance on parent and bus transportation, and makes the area surrounding the school safer for all pedestrians.

Congress recently passed new legislation to establish the Safe Routes to School program, by which the U.S. Department of Transportation shall use federal transportation funds to permit localities to build bicycle and pedestrian safety and traffic-calming programs. DOT will make grants available to local governments under the program.

Seattle has initiated a Safe Routes to School program at approximately 60 elementary schools. A route guide, updated yearly and provided to the school districts for distribution by the State Department of Transportation, shows the preferred route for walking to school safely. Parents are expected to help their child learn the safest route and good safety habits when walking, such as to stop, look, and listen for oncoming vehicles before crossing; to walk quickly, but don't run; to use crosswalks, stop signs, traffic signals, school patrols and adult crossing guards; and, where no walkways are provided, to walk on the left side of the roadway facing approaching traffic but as far from moving travel lanes as possible.

Maine DOT coordinated a federally-funded, collaborative research project to determine existing trip rates of bicycling and walking to school in the state. The Maine Safe Ways to School project was undertaken with the expectation that the information learned through this pilot project would be useful in developing state and local policies and practices which would promote bicycling and walking to schools statewide. Maine DOT has an ongoing interest in understanding the reasons why more students are not biking and walking to school and under what conditions they might change their habits. One aspect of achieving an increase in the number and frequency of children who walk to school is educating motorists to be more aware of bicyclists and pedestrians, as well as teaching children age-appropriate skills regarding walking and bicycling safety. This project report is available at: <http://www.maine.gov/mdot/opt/bike/>

The Kids and Transportation program of Portland, Maine teaches children ways to get around without using a car and promotes safety and critical thinking about our transportation choices. The mission of the free program is to educate youth and teachers about how transportation choices impact air pollution, land use, personal safety, and the quality of life in their community.

Numerous classes are taught through Kids and Transportation, including a pedestrian safety class where children are taught the rules of the road, appropriate clothing and visibility, and how to interact safely with the roadway environment. One popular class for teachers covers local and national transportation topics with lessons and experiences they can use in their classroom. These classes meet at a different location each day, using a different form of transportation whenever possible.

Kids in Transportation offers printed material, presentations, teacher training and other resources on bicycle, walking, rail, bus, ferry, carpooling, and air travel topics for all grade levels. In cooperation with the Greater Portland Council of Governments, a comprehensive brochure was developed for children entitled *Safe Walking Guide*. This guide answers questions such as: Where should I walk? Where should I cross the street? How do I use pedestrian traffic signals? What do the signs mean? What do crossing guards do? What are things I should watch for? What should I know about parked cars? Can car drivers see me in the dark?

The organization also produced a map entitled *A Kid's Guide to Getting Around Greater Portland*, to help kids of all ages get where they need to go by using different kinds of transportation. The map emphasizes that using kid-powered wheels and feet can get a child almost anywhere in town without asking parents to drive. The map features the locations of schools, museums, libraries, parks, recreation programs, theatres, concerts, sporting events, cinemas, fast food and shopping centers.

Cambridge, like many other cities, participates in Walk our Children to School Day, an annual international event when children and adults walk or bike to school. Started in 1997 with just a few schools, thousands of people in the United States and twenty other countries now walk to school together on the first Wednesday in October. The event raises awareness about pedestrian safety among children while providing kids and parents the opportunity to have fun, exercise, and improve their health. The day is spent teaching children safe walking techniques and steps parents can take to create more walkable communities by advocating for more crosswalks, crossing guards, and better driver behavior.

“Cambridge Walks” is a citywide campaign to encourage residents of all ages to walk for the betterment of their health and the environment. Cambridge Walks supports current walking initiatives; making walking a safe, accessible, and attractive alternative to getting around; and creating new initiatives to encourage walking and physical activity. The effort grew out of the collaborative spirit that created “Walk Your Children to School Day.”

“The Walking (or Cycling) School Bus” has become increasingly popular in the last few years. A walking school bus provides children with a safe and healthy mode of transportation to school. The idea is simple: a designated adult supervisor “picks up” each student, house by house, on foot. The students walk to school together along a set route, all the while enjoying fresh air, exercise, and friendly conversation.

Public Information, Education and Training

Most of the host cities concentrated their presentations on educational programs related to children and young adults. However, many of the sections contained in the chapters of this document have elements of public information, education, training, and enforcement associated with them to promote pedestrian safety.

The Parent Teacher Associations (PTAs) are an important asset in the education model. These organizations have better access to curriculum within the school, as well as extra-curricular activities sponsored or endorsed by a school district. The PTAs are another cadre of educators whose resources are both efficient and effective for pushing the safety message to the kids and their parents.

Pedestrian public education activities seek to encourage pedestrians to cross at controlled crossings or the safest point on the road, to raise awareness of the consequences of unsafe pedestrian activities, and to encourage motorists to drive carefully where pedestrians are likely to be walking.

Portland, Maine’s Transportation Plan, Planning for Pedestrians, includes a major education component. The guiding principle behind this plan is to provide maximum mobility in a transportation system which encompasses all needs, balances competing objectives, and promotes economic vitality and quality of life. A transportation plan should include educational text and graphics, neighborhood education meetings, targeted enforcement, public service announcements, posting on the website, and a traffic-calming policy that requires neighborhood support. The planning process emphasizes public involvement through focus groups, surveys, and annual meetings.

Driver education is not confined to the classroom. Vehicle-pedestrian conflicts may be reduced by providing additional information to motorists, including signs stating the need to watch for pedestrians when turning at intersections. Many communities, including New York State, place signs on the roadway’s centerline near crosswalks alerting motorists to the new “State Law YIELD for pedestrians in crosswalk.”

Other signage upgrades are aimed at educating pedestrians. Walk/Don’t Walk traffic signs are being replaced with the international pedestrian symbol of a person walking and an open hand warning pedestrians to stop. The new signs are easier to understand, especially to tourist and immigrants who may not read English. The upgraded signals are powered by light-emitting diodes, or LEDs, which use eight to 20 watts of electricity, compared with 67 watts for the old

signs. LEDs are brighter than conventional bulbs and last six times longer, thereby saving money on energy costs. Furthermore, many communities are investing in pedestrian countdown timers which alert the pedestrian to the number of seconds they have to safely cross the street.

Educating the Elderly

Older pedestrians can benefit from education on safe street crossing techniques and the meaning of pedestrian crossing signals.

ECONOMICS

Pedestrian safety and accommodation are not mutually exclusive in the host cities that the team visited. Both seem to co-exist and even complement each other. The ability of a host city to simultaneously employ pedestrian safety initiatives and accommodations has a direct impact on street life and pedestrian-related commerce. This section describes how our host cities pay for pedestrian safety improvements, use economic incentives to promote non-polluting transportation, and effect savings in the use and maintenance of their infrastructure and operations.

In an effort to reduce vehicle trips, thereby reducing potential vehicle-pedestrian conflicts and improving the safety of its students, the University of New Hampshire provides free bus service for their students on campus and in the Town of Durham. Students, faculty, and any other residents living in the surrounding towns of Newington, Portsmouth, and Dover may ride the bus for one dollar. The positive economic reinforcement of inexpensive public transportation was augmented by the negative reinforcement of an increase in on-campus student parking fees from approximately \$30 to \$600 per year.

Many new and improved crosswalk and long line paints, polymers, and preformed tapes are now available commercially. While expensive, these pavement-marking materials are worth their extra cost due to the added safety value for pedestrians. One pavement marking delivers true wet reflectivity that performs as well at night and under water as it does during the day and when dry. However, many wet paint products do not wear well when applied in standard crosswalks due to the repeated crossing of the transverse lines by motor vehicle traffic. Other crosswalk patterns such as ladder and zebra striping permit less wear of paint while increasing its conspicuity.

Many communities throughout the country and New York State have elected to convert incandescent lights to Light-Emitting Diode (LED) technology for their traffic signals and variable message boards. LEDs are not only brighter than conventional incandescent bulbs, but also last many times longer, thus saving resources on maintenance since state and local highway agencies no longer need a proactive strategy to replace bulbs in their signal heads every year.

After many attempts to find a durable marking for crosswalks and other high-traffic areas, the Durham Department of Public Works experimented successfully with striping its crosswalks with tennis court paint which exhibits better durability and provides guidance for longer periods of time, consequently making a safer atmosphere for pedestrians and motorists. In addition, and related to the economics of crosswalk treatments, the City of Durham also experimented with stamped asphalt pavement for pedestrian crossings with poor success. Motor vehicle traffic within the crossing wore down both the pattern and red color designed to simulate brick pavers.

A major obstacle to pedestrian safety and accommodation in the Northeast is winter weather, where snow, freezing rain, and other environmental constraints demand the constant maintenance of pedestrian facilities; sidewalks, pedestrian ramps at corners, crosswalks, and bus shelters. Pedestrians often must walk in the road, already narrowed due to snow storage on the

shoulders, or cancel the walking trip altogether to avoid injury or major inconvenience. Parents with strollers are unable to negotiate the narrow paths on sidewalks created by the accumulation of snow.

Jurisdictional conflicts and competing priorities between the maintenance of vehicle facilities and pedestrian facilities also create problems with keeping both free of snow. Snow is often plowed, blown from the sidewalk onto the street, or landscaped strip between the sidewalk and the roadway, only to have the snow from the roadway plowed back on to the sidewalk after it has been cleared.

Our host cities demonstrated the ability to successfully manage snow removal, a key to maintaining pedestrian facilities, especially for the elderly, during the winter. Some of the communities designated priority routes that were maintained throughout the year, but especially after every winter storm. Priority routes usually coincided with major pedestrian corridors or routes to school.

In Portland, Maine sidewalk use is prioritized with respect to maintenance and capital improvement. Sidewalks included in a school walking route are given priority for maintenance and improvement.

Property owners in Portland, Maine are responsible for clearing their own sidewalks. The city developed a brochure outlining the responsibilities of the homeowner and the fines and other penalties the homeowner may incur should he/she not properly maintain the sidewalk. If the owner is elderly or has physical limitations, the sidewalks are cleared with the use of individuals sentenced to community service. The city will also maintain sidewalks and bill the property owner should he/she refuse to maintain the sidewalks. Code enforcement is used to ensure compliance.

Most municipalities face questions on how to fund pedestrian safety projects and programs, and our host cities discussed the lack of available funding. Transportation officials in Portland, Oregon noted that the city now lacks the resources to fund traffic-calming projects that were once well financed. As mentioned, our hosts use federal transportation money to fund pedestrian and bicycle projects, but have also developed other successful mechanisms to fund or assist in funding their programs. Portland, Oregon funds their community and school traffic safety programs with court fees from moving traffic violations. Portland also has a program dedicated to the improvement and rehabilitation of pedestrian facilities, access, and safety. Durham, New Hampshire uses 1.5 percent of all traffic fines to fund pedestrian and bicycle safety projects and programs. Seattle funds safety programs by doubling fines for moving violations in school zones. In Portland, Maine the School Walking Routes Report was funded originally with CMAQ monies, but is now underwritten by private businesses.

One poor economic decision repeated by many communities is the installation of pedestrian underpasses. Evidence from Portland, Maine shows that underpasses are used by pedestrians only as a last resort and are much more expensive than other crossing alternatives. One reason may be the perception of a lack of security.

ENFORCEMENT

Education and enforcement are key elements to effect reductions in pedestrian fatalities. Unlike engineering improvements, these efforts target behavioral changes. Both should be considered long-term investments and often result in significant dividends in the future.

All enforcement has an element of education. A traffic citation is sometimes referred to as a “training tool.” New enforcement programs merge education and enforcement by using the “carrot and stick” approach. This two-pronged approach offers fair warning to violators, first by informing the benefits of being a dutiful pedestrian or a careful and attentive driver, while at the same time detailing the consequences of not being one. After potential offenders have had ample warning and time to learn and check their behavior, enforcement begins. This enforcement usually involves financial penalties, but may merely consist of a warning and/or additional education.

Conditions Observed

Our host cities each exhibited their own aggressive pedestrian safety programs, with the exception of an apparent weak link between the police and other transportation professionals. In some cities visited, transportation officials stated that they worked closely with police, but there seemed to be little meaningful coordination between transportation agencies and the police, who were not present at our meetings. Conversely, team members know that coordinated inter-agency operations can reduce crash statistics and pedestrian fatalities.

As a result of this lack of coordination between the law enforcement community and other transportation and safety professionals in the cities visited by our group, this section is necessarily brief. However, it is the opinion of our group that design cannot substitute for the enforcement of traffic laws, which is a necessary and integral component of any pedestrian safety campaign. It is also recognized that enforcement cannot substitute for sound engineering designs. Therefore, many of the enforcement recommendations in this document, such as enforcement of codes and permit requirements, are addressed in other areas of this document. The evaluation section of this document describes New York City’s TrafficStat process as the model for safety and pedestrian safety evaluation.

Targeted Pedestrian Safety Operation

In the year 2000 Oregon Department of Transportation (ODOT) embarked on a federally-funded pedestrian safety program designed to enhance existing education and law enforcement programs. Part of ODOT’s strategy to reduce fatal traffic crashes involving pedestrians was to train law enforcement personnel to conduct Pedestrian Safety Enforcement (PSE) Operations. PSE Operations seek to educate motorists and pedestrians in targeted problem areas by testing compliance with traffic laws regarding pedestrian-vehicular interactions at crosswalks. The training workshops included over 50 law enforcement agencies. A comprehensive training manual and video were produced and provided free of charge to any requesting agency. In fact,

enforcement agencies were required to take the training in order to qualify for Section 402 Safety funding from the Governor's Highway Safety Office.

PSE Operations seek to raise driver awareness regarding the right-of-way of pedestrians; reduce the number of complaints by pedestrians at problem intersections, raise public awareness and generate positive media attention using a highly visible enforcement activity, and reduce collisions, injuries, and economic losses associated with auto-pedestrian crashes.

The local news media are informed of the purpose, times, and locations of PSE Operations, in part to remove any perception of entrapment. Local elected officials are notified in an effort to rally support for the operation. Other city agencies are recruited to hand out educational and retro-reflective material.

Enforcement efforts are conducted during daylight hours and fair weather. Each targeted crosswalk is measured and braking sight/distance calculations are made in advance to insure appropriate fairness in judging failure to yield violations. A traffic officer in brightly colored clothing acts as the pedestrian. When possible, signs are placed prior to the crosswalk alerting motorists that they are entering a pedestrian enforcement zone.

A study in Redmond, Washington found drivers failed to yield 50 to 60 percent of the time to pedestrians in a crosswalk. As a result of the enforcement/education program, similar to Oregon's program, pedestrian fatalities at subject crosswalks declined by 43 percent over three years. Some local police departments found the program so successful that they expanded the criteria to include bicycle right-of-way violations and school-zone-speed violations.

Conclusion

As stated earlier the most significant shortcoming in many of the cities visited was little, if any, regular formal interaction with their local police officials. There also appeared to be a lack of any crash analysis, particularly before and after comparisons, by these cities' agencies which cited local and state reporting systems as the problem. Analysis of crash data could be greatly enhanced by the timely feedback of police officers who actually take the reports.

Most municipalities recognize that survey information should be gathered from facility users whenever planning major changes to a city's transportation infrastructure. Portland, Maine surveyed elementary school students when developing walking routes to school. This is innovative thinking and should be commended. However, law enforcement's input was unsolicited.

Officers spend their entire day observing human behavior. These observations could be invaluable to educators, engineers, and planners developing a safety project or program. Local law enforcement personnel should be invited to join any discussions involving engineering and education planning.

EVALUATION

The TrafficStat Process

Evaluation is always part of any successful project or program; that which can be measured can be changed. As mentioned in the enforcement section, the team observed little coordinated analysis of crash data as it relates to installing engineering improvements, increased enforcement, or what affect either have had toward reducing crashes. The New York City Police Department (NYPD) has had demonstrable success in reducing deaths and injuries through the TrafficStat process. An overview of TrafficStat is included here.

To quickly respond to traffic conditions, the NYPD created the Traffic Management Center (TMC), a 24 hour, 7-day/week information center that monitors traffic conditions throughout the city in coordination with the City and State Departments of Transportation. The TMC utilizes advanced traffic control surveillance and other state of the art Intelligent Transportation System technologies to expedite the city's response at the scene of traffic incidents. The TMC also gathers and disseminates information relating to incidents which may impact traffic, such as fires and building collapses.

To manage the extraordinary amount of vehicular and pedestrian traffic within New York City, the Department used CompStat, its crime-reduction program, as the model in developing and implementing Trafficstat to reduce accidents and improve traffic flow. The TrafficStat process is based on four steps: accurate and timely intelligence, effective tactics, rapid deployment, and relentless follow-up and assessment.

Accurate and Timely Intelligence

The Department developed a Traffic Accident Management System (TAMS) to identify within each of 76 precincts, problem locations with a high rate of accidents. It also identifies the total number of accidents, injury accidents, fatal accidents, and the contributing factors at each location.

Reports are generated with statistics containing enforcement efforts, engineering recommendations and education of each precinct's personnel being reviewed.

Accident reports are reviewed to determine patterns of accident times, days of the week, weather conditions, and any other relevant information. In addition, the Department thoroughly analyzes each fatal accident.

Effective Tactics

Effective tactics are developed using the three “Es” of accident reduction: enforcement, engineering, and education. Enforcement targets the specific violations. Hazardous offenses such as speeding, running a red light, and improper turns contribute to a location’s high-accident rate. Enforcement is conducted during the hours and days of the week when accidents most often occur.

The Traffic Safety Officer’s problematic location survey is likely to identify possible engineering solutions. Once identified, an on-site meeting is held with representatives from the City Department of Transportation, which is responsible for designing and implementing engineering changes. Even minor changes at a location, such as installing additional signs or replacing worn pavement markings, can help reduce accidents.

Education plans inform the public about traffic safety issues. Traffic Safety and Community Affairs officers routinely conduct traffic safety lectures at schools, senior citizen centers, and other community meetings. Personnel assigned to police checkpoints distribute DOT traffic safety literature.

Rapid Deployment

Precinct summons and radar speed-enforcement personnel spend significant time addressing violations at problematic locations. Patrol cars are directed to provide additional enforcement at problem locations. Supervisory personnel are required to visit problem locations to ensure personnel are actively engaged in enforcement activities.

Relentless Follow-up and Assessment

The NYPD ensures appropriate follow-up and assessment by conducting weekly TrafficStat meetings which examine a command’s accident reduction strategies and provide direction for designing and implementing plans to correct problems. An important part of TrafficStat is the participation by other City agencies, including the Department of Transportation Borough Commissioner and, when appropriate, State Department of Transportation representatives. This process ensures a coordinated effort by all agencies responsible for traffic control.

Results

The NYPD is firmly committed to the use of TrafficStat. The success of the program is measured in the resulting reduction in traffic fatalities, which dropped from 494 in 1997 to 366 in 1998, a decrease of 26 percent in the first year of the program. Pedestrian and bicycle fatalities and injuries have also been reduced, as have alcohol-related fatalities. In 1999 summonses for hazardous violations increased by 27 percent, and the Department issued 107,000 speeding tickets, 86,000 red light summonses, and 645,000 double parking summonses. The Traffic Violations Bureau conviction rate increased from a low of 37 percent in 1997 to 53 percent two years later.

A police department need not have thousands of uniformed members to use the methods described here. After all, the key to success is the activity of the individual precinct and not the size of the whole department. The concept of local authority and accountability, the four principles of accident reduction, and the use of a forum for examining results can easily be applied to smaller police departments.

REPORT CONCLUSION

In New York approximately 340 pedestrians are killed every year. While the majority of these pedestrian fatalities occur in Down-state New York, there are opportunities to improve pedestrian safety statewide. The impact of these fatalities and injuries has a dramatic effect both personally and economically on communities throughout the state. Some could argue that New York enjoys one of the lowest pedestrian fatality and injury rates in relationship to pedestrian trips generated. However, the reality is that transportation professionals cannot continue to accept the fact that one pedestrian per day is killed and countless others injured throughout the State of New York. Many state and local officials are diligently working on the program with varying degrees of success. Although the number of pedestrian fatalities has been on a decline, these are still promising countermeasures that need to be employed to accelerate the downward movement.

The scanning tour team observed some very good examples of public policy, local ordinances, engineering, and public information and educational programs that deserve some consideration in New York State. More specifically noted were the planning documents and plans that promoted and enforced pedestrian safety. The host cities created equality, and in some cases favored, pedestrian safety over motor vehicle safety based on warrants and merit.

Traffic calming is an effective way of improving pedestrian safety by slowing traffic or reducing the volume of traffic on a particular roadway. Traffic calming can and has been used effectively in the “snow belt” to improve pedestrian safety. As with many new concepts, educating the users and maintainers of these devices is key to the prolonged success. Transportation and public works officials must not only believe in pedestrian safety, but be empowered to implement and enforce pedestrian safety measures.

Maintaining an inventory of the infrastructure, accident history, and traffic control features when prioritizing capital improvements and needed maintenance ensures the best use of public funds. Innovative approaches to highway design and pedestrian safety may also optimize vehicle capacity while enhancing pedestrian safety. Many of these innovative designs and practices were observed and are noted in this document.

There are many projects and programs across the State of New York that have made significant progress in reducing the number and severity of pedestrian crashes. However, more needs to be accomplished in order to drop the overall number of pedestrian fatalities and injuries even further. This report summarizes some of those efforts from other areas around the country that have been implemented. Opportunities to further incorporate or enhance pedestrian safety into larger program areas such as public health, brain trauma prevention, highway safety, behavioral and educational programs, targeted enforcement, routine maintenance, capital projects, safety and permit projects and enhancements could help expedite a much needed cultural shift.

Lastly, the success of this report is directly related to the tremendous efforts and information shared by our host cities. The New York delegation cannot overstate our gratitude for the hospitality and efforts in showing us their best practices and successes for pedestrian safety. This scanning tour document provides information and experiences of other transportation agencies across the country and provides opportunities for transportation agencies across New York State to improve pedestrian safety and facilitate efficient traffic flow.

RECOMMENDATIONS

Road safety audits should be an integral component of any New York local road safety program. In addition to walkability audits, a pedestrian safety component should be included in every general purpose road safety audit.

Roads and intersections should be designed with all users in mind, not just motor vehicles. For example, make the curb radius as tight as possible while still accommodating the traffic that needs to use the intersection.

Municipalities throughout New York State adopt programs to require the strict maintenance and enforcement provisions related to sidewalk maintenance, clearing, and repair.

Municipalities throughout New York State should begin to experiment with the use of wet-reflective markings to delineate pedestrian crossings. Recessing these wet reflective markings or in-laying them into hot asphalt material could extend their useful life and enhance safety for longer periods of time between repainting.

Since the City of Durham, New Hampshire and New York State have used stamped asphalt with less success in areas where heavy motor vehicle traffic accelerates the wearing away of the distinctive pattern and color. Because of Americans with Disabilities issues, it is recommended that stamped asphalt and/or brick pavers should only be used for edging.

Municipalities should consider the use of LEDs, not only to improve safety, but to improve conspicuity of the signal. LED countdown signals have also proved successful where used.

Overhead placement of traffic control devices should be used, especially at crosswalks where more conspicuity is needed.

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RECOMMENDED READING

Crosswalk Safety

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Hefferan, Jennifer and Lagerwey, Peter, *The City of Seattle, WA, USA, Crosswalk Inventory and Improvement Program*, *ITE Journal*, January 2004.

Safe Routes to School Programs

Portland, Oregon, Safe Routes to School Program: www.saferoutesportland.org

Marin County, CA, Safe Routes to School Program: www.saferoutestoschools.org

Smith, Duane, *Handbook of Simplified Practice for Traffic Studies Chapter 6: School Zone Programs*, Center for Transportation Research and Education, Iowa State University Ames, Iowa, November 2002, <http://www.ctre.iastate.edu/pubs/traffichandbook/>

Accessible Sidewalks

A wealth of information is available from the Access Board, including:

Americans with Disabilities Act Accessibility Guidelines, The Access Board, Washington, DC, September 2002. This is the regulation covering accessibility of all public facilities, including sidewalks and other walkways. <http://www.access-board.gov/adaag/html/adaag.htm>

Accessible Rights-of-Way: A Design Guide. The Access Board, Washington, DC, November 1999. This provides guidance for designing walkways and other parts of the highway environment to aid wheelchair users, and people with limited vision or who are blind. <http://www.access-board.gov/provac/commrept/PROWreport.pdf>

Oregon DOT street design guidance publications are available from egov.oregon.gov.
Neighborhood Street Design Guidelines (Guidance for local residential streets)
<http://egov.oregon.gov/LCD/docs/publications/neighstreet.pdf>

Main Street... When a Highway Runs Through It (Guidance for walkable arterials)
<http://egov.oregon.gov/LCD/TGM/docs/mainstreet.pdf>

RECOMMENDED READING (*continued*)

Federal Highway Administration Publications

A Review of Pedestrian Research in the United States and Abroad, FHWA Turner-Fairbanks Highway Research Center, McLean, VA, 2004.

http://www.walkinginfo.org/pdf/PedSynth/Ped_Synthesis_Report.pdf

A number of other pedestrian safety publications can be downloaded or ordered at

<http://www.fhwa.dot.gov/environment/bikeped/order.htm>

BIOGRAPHIES

Emmett McDevitt is a Transportation Safety Engineer for the New York Division Office and is responsible for all highway safety programs on Federal-aid highways across New York State. His primary emphasis areas and experience are in the areas of Roadside Design, Geometric Design, Pedestrians and Work Zone Safety. Mr. McDevitt was part of the team that developed the new Highway Design Manual for Older Drivers and Pedestrians and is an instructor of the course. Mr. McDevitt has worked with New York City DOT and New York State DOT to reduce pedestrian fatalities and serious injuries, especially in the standards used for pedestrians in the rebuilding of Lower Manhattan. Mr. McDevitt has assisted State Highway Agencies and Canadian Transportation Agencies in the design and performance of roadside hardware, barrier design applications, and work zone safety. He is the author of a research report documenting the performance and success of the Modified Eccentric Loader Terminal (MELT). He has also assisted the National Transportation Safety Board (NTSB) in investigations of multiple fatality motor vehicle and pedestrian accidents. In his 20 years with the Federal Highway Administration, Mr. McDevitt has worked 5 years in fast track construction in the 19 western states, and 15 years in highway safety in Wisconsin, Colorado, New Hampshire, and New York. Mr. McDevitt earned his BSCE from New Mexico State University.

Jim Mearkle is a County Traffic Engineer for the Albany County Department of Public Works in New York State and is responsible for the safety and operations of 290 miles of county highways. At the start of this project, he was the Traffic Safety Assistance Engineer for the Cornell Local Road Program where he assisted local governments with traffic safety issues. Prior to that, he was a Civil Engineer I with the NYS Department of Transportation, where he audited design and construction projects for pedestrian/bicyclist, geometric design and roadside safety issues. He holds a BSES degree from Trinity University in San Antonio.

Elena Modicamore is a Transportation Planner with the Greater Buffalo Niagara Regional Transportation Council (GBNRTC) where she has worked for over seven years. She works to improve pedestrian, bicycle and multimodal travel within Erie and Niagara Counties and has worked specifically on developing the Shoreline Trail, a 67-mile continuous pathway which runs north/south through the region. She also plans and presents programs such as the International Trails Day, the Intersection Safety Course for children, Healthy Transportation Day, and produces the Erie/Niagara Bicycle Route Guide. Additionally, her goal is to increase bicycle trips of residents, thus lowering pollution levels and contributing to the better overall health of the region by increasing the opportunity for physical activity. She volunteers her time to the Western New York Stop Red Light Running Foundation and teaches driver improvement classes.

BIOGRAPHIES *(continued)*

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