International Technology Scanning Program

February 2010

Pedestrian and Bicyclist Safety and Mobility in Europe

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16. Abstract Pedestrian and bicyclist deaths accounted for 14 percent of U.S. highway fatalities in 2008. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of five European countries to identify and assess effective approaches to improve pedestrian and bicyclist safety and mobility. The scan team gathered information on strategies and approaches in the areas of engineering, education, enforcement, encouragement, and evaluation. The team learned that many of the countries studied have established an urban street user hierarchy that gives the highest priority to walking, biking, and public transit. Team recommendations for U.S. implementation include encouraging transportation policy that gives walking, biking, and other nonmotorized modes the highest priority in the road user hierarchy. The team also recommends evaluating innovative strategies and designs to improve pedestrian and bicyclist safety for possible U.S. use, institutionalizing traffic safety education that starts at an early age, and developing programs that encourage regular walking and biking.			
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Pedestrian and Bicyclist Safety and Mobility in Europe

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International Technology Scanning Program

The International Technology Scanning Program, sponsored by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the National Cooperative Highway Research Program (NCHRP), evaluates innovative foreign technologies and practices that could significantly benefit U.S. highway transportation systems. This approach allows advanced technology to be adapted and put into practice much more efficiently without spending scarce research funds to re-create advances already developed by other countries.

FHWA and AASHTO, with recommendations from NCHRP, jointly determine priority topics for teams of U.S. experts to study. Teams in the specific areas being investigated are formed and sent to countries where significant advances and innovations have been made in technology, management practices, organizational structure, program delivery, and financing. Scan teams usually include representatives from FHWA, State departments of transportation, local governments, transportation trade and research groups, the private sector, and academia.

After a scan is completed, team members evaluate findings and develop comprehensive reports, including recommendations for further research and pilot projects to verify the value of adapting innovations for U.S. use. Scan reports, as well as the results of pilot programs and research, are circulated throughout the country to State and local transportation officials and the private sector. Since 1990, more than 80 international scans have been organized on topics such as pavements, bridge construction and maintenance, contracting, intermodal transport, organizational management, winter road maintenance, safety, intelligent transportation systems, planning, and policy.

The International Technology Scanning Program has resulted in significant improvements and savings in road program technologies and practices throughout the United States. In some cases, scan studies have facilitated joint research and technology-sharing projects with international counterparts, further conserving resources and advancing the state of the art. Scan studies have also exposed transportation professionals to remarkable advancements and inspired implementation of hundreds of innovations. The result: large savings of research dollars and time, as well as significant improvements in the Nation's transportation system.

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Asian Bridge Structures (1997)
Bridge Maintenance Coatings (1997)
Northumberland Strait Crossing Project (1996)
European Bridge Structures (1995)

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Contents

Figures

Table

Executive Summary

Introduction

In May 2009, a team of 12 transportation professionals from the United States with expertise in bicycling and walking visited five countries in Europe to identify and assess effective approaches to improve pedestrian and bicyclist safety and mobility. The countries visited—Denmark, Germany, Sweden, Switzerland, and the United Kingdom—were chosen because of their innovative approaches to nonmotorized transportation, as well as the potential transferability of their policies and practices. Some, like Denmark, experienced an increase in car use in the 1960s and 1970s and subsequently reoriented their transportation policy to give priority to bicycling and walking. The scan team heard presentations from and had informal discussions with the foreign hosts. During most visits, the scan team also went on guided field visits (by bike as well as by foot) to better understand and experience the design and operation of various walking and bicycling facilities. These field visits were invaluable in documenting the facilities through photos and video, observing traffic behavior, and experiencing firsthand how well a design or operational strategy worked.

The purpose of this scanning study was to identify and assess effective approaches to improve pedestrian and bicyclist safety and mobility. The specific topics of interest were the following:

- **Improving pedestrian and bicyclist safety**—Approaches (engineering, education, enforcement, and policy) that have been successful in improving pedestrian and bicyclist safety
- **Safe Routes to School programs**—Approaches and policies for improving safety for child pedestrians and bicyclists, especially those that support programs like Safe Routes to School
- **Monitoring usage levels and exposure**—Quantitative methods of monitoring pedestrian and bicyclist usage levels (for example, counts and surveys) and exposure to crashes
- **Safety research and evaluation**—Recently completed or ongoing research and collaboration opportunities in pedestrian and bicyclist safety

The scan team identified numerous possible approaches to improving pedestrian and bicyclist safety and mobility in the United States. The scan team also prepared a list of implementation items for those approaches that should be pursued in the United States. This executive summary provides an overview of the team's findings and recommendations.

Summary of Findings and Conclusions

The scan team gathered a considerable amount of information on various strategies and approaches that could be used to improve pedestrian and bicyclist safety and mobility in the United States. This section highlights the most important findings from the scanning study. The "General Findings and Conclusions" section describes the broader issues and themes that emerged on the scan and provides a context for understanding the details provided in the body of the report. The "Key Findings" section provides details on specific topics and is organized around the 5E approach (an expanded version of the 3E approach commonly used in traffic safety improvements):

- **Engineering**—Designing and building infrastructure that is safe, convenient, and comfortable to use
- **Education**—Educating all transportation system users on safe and appropriate behavior
- **Enforcement**—Enforcing existing traffic laws
- **Encouragement**—Encouraging and promoting the use of sustainable travel modes
- **Evaluation**—Monitoring the results to ensure that goals are met

General Findings and Conclusions

- **Implementing foreign practices in the United States will require a careful, evidence-based approach. Some policies, practices, and designs are easily transferrable and can be immediately implemented.** However, implementing some foreign policies and design practices in the United States may require a safety evaluation and/or implementation criteria. For example, separated bicycle facilities should be evaluated in the context of typical motorist and bicyclist behavior and safety experience in the United States before being widely implemented. Separated onroad bicycle facilities may be quite effective in Denmark, for example, but their effectiveness may be at least partly a product of Danish culture and behavior or a result of their widespread implementation.

However, foreign practices (like separated bicycle facilities) should not be dismissed outright simply because current American culture and behavior may be different. Culture and behavior can be changed, but these changes often occur over longer time periods than covered in a typical safety evaluation. For example, separated bicycle facilities could be evaluated at a few trial locations in the United States and show no clear safety benefits in a typical 1- to 2-year safety evaluation. But in 5 to 10 years, as more bicyclists use separated facilities and motorist and bicyclist behavior adapts, safety could improve dramatically. Unfortunately, this increase in safety would not be captured in typical safety evaluations because they do not capture long-term behavior changes. Many of the host countries have undergone a culture change over the past 40 years that has returned to an increased emphasis on walking and bicycling safety and mobility. Changes of this sort can happen if fostered by a careful, evidence-based approach.

- **Numerous factors contribute to higher rates of pedestrian and bicyclist safety improvements and higher walking and biking mode splits in the host countries.** From all of the information the scan team gathered and everything it observed, it appears that higher levels of walking and biking safety and mobility are due to a deliberate combination of policies, approaches, and influences that include the following:
  - Integration of transportation and land use policy
  - Transportation planning and design policies that are mode neutral or that give priority to vulnerable road users (like pedestrians and bicyclists)
  - Political support at all levels, including elected officials, government staff, and the general public
  - Provision and pricing of motor vehicle parking
  - The high costs of owning and operating a private motor vehicle (sales tax, annual registration fees, gas, parking, fines for moving violations, etc.)
  - A comprehensive, continuous, integrated approach that includes elements such as the following:
    - Integration with and widespread availability of public transit
    - Connected onstreet and offstreet walking and biking networks
    - Ongoing promotional campaigns and activities
    - Traffic safety education for children throughout their school years
    - Visually rich, pedestrian-scale built environment
    - Prohibition against right turn on red except where specifically permitted
    - Routine photo enforcement
    - Numerous other policy and facility details that make walking and bicycling easy, convenient, and enjoyable

- **Many of the foreign hosts have established an urban street user hierarchy that gives the highest priority to walking, biking, and public transit.** The street user hierarchy has been developed to support a range of public policy goals, such as livability, sustainability, public health, climate change, and congestion management. The hierarchy guides decisions about transportation policy, planning, design, operations, and maintenance. For example, typical street design begins by considering the space needs of pedestrians and bicyclists first, rather than designating the motor vehicle space and then giving pedestrians and bicyclists the leftover space (if there is any). Another example from Sweden is its winter snow removal policy, which gives highest priority to streets with transit routes and bicycling facilities.

- **"Safety in numbers" (also called "awareness in numbers") is a clear motivator behind the promotion of walking and bicycling as a safety improvement strategy.** Most host countries indicated that they promoted walking and bicycling for a variety of reasons (lower overall transportation delivery cost, sustainability, space and energy efficiency, health and wellness, etc.), and improved safety was often mentioned as one of the outcomes of higher levels of walking and biking. Their rationale is that when pedestrians and bicyclists are a common element in the street environment, motorists expect their presence and take the necessary precautions at potential conflict points, such as when a motorist turns right across a through bicycle lane. Anecdotally, the scan team routinely observed this type of motorist behavior during field visits, in which motorists were more aware of pedestrians and bicyclists at conflict points. However, it is not clear whether this improved motorist awareness was due primarily to the increased numbers of pedestrians and bicyclists, or due at least in part to improved roadway designs, motorist education, and/or police enforcement.

Key Findings

Engineering

- **There was thoughtful consideration of a "false sense of security and safety" when designing pedestrian and bicyclist facilities.** This expression was mentioned numerous times by the engineers and planners responsible for facility design details. The host countries are not rashly constructing facilities to promote walking and bicycling without regard for safety. In fact, some host countries pay meticulous attention to crash and injury data to determine which road designs are safest for pedestrians and bicyclists. For example, Sweden has implemented nationwide the STRADA (Swedish Traffic Accident Data Acquisition) database that integrates police crash data and hospital admissions data. The STRADA database addresses the underreporting problem common to walking and biking, and gives Swedish engineers and planners a more complete picture of walking and biking safety.

- **The scan team observed several innovative traffic signal features and design practices that have the potential to improve pedestrian safety in the United States:**
  - Passive detection of pedestrians in crosswalks to truncate, extend, or cancel the pedestrian phase at traffic signals
  - Near-side traffic signals that reduce motorist encroachment on the pedestrian crosswalk
  - Near-side pedestrian signal heads placed to encourage pedestrians to view oncoming traffic
  - Raised crosswalks at unsignalized pedestrian crossings (applied at midblock locations, roundabouts, entrances to traffic-calmed districts, etc.)
  - Crossing islands, even if confined or limited space requires the use of smaller islands
  - Railing used to direct pedestrian movements to defined crossing locations

- **The scan team observed several approaches and design practices that could be used to improve bicyclist safety in the United States:**
  - Approaches to address right-turn crashes, such as advance stop lines for bicyclists, "Trixi" (heated convex) mirrors or other specialized motor vehicle-based mirrors, bike boxes, leading green phase for bicyclists, and right-turn-on-red restrictions for motorists
  - Separated facilities, such as cycle tracks, separated bike lanes, and shared-use paths with delineated space for pedestrians and bicyclists
  - Bicycle-specific traffic signals to reduce turning conflicts at signalized intersections
  - Pavement markings, such as dashed bike lanes through intersections, colored lanes at conflict points, and longitudinal bike symbols at driveways and stop-controlled cross streets (oriented to be seen by motorists turning across the bike lane)

- **The scan team observed the use of low-speed street designs in both residential and commercial areas that were especially conducive to walking and bicycling.** For example, the city of Bristol, England, has implemented 20 mile-per-hour (mi/h) (32.1 kilometer-per-hour (km/h)) "home zones" in its new residential development. Several cities in Sweden, Germany, and Switzerland also have implemented low-speed streets (20 to 30 km/h (12.4 to 18.6 mi/h)) in both residential and commercial areas. However, several foreign hosts indicated that certain conditions should be met for these low-speed street designs to operate properly: 1) speeds of the different modes should be similar, 2) flows (volumes) of users should be similar, and 3) "see and be seen" is a critical design element.

- **The scan team observed close integration of bicycling and walking considerations with public transit (including intercity rail) that makes longer intermodal commutes by bike practical as well as safer and more convenient.** These considerations include the following:
  - A variety of bike parking solutions at stations, including plentiful and convenient bike racks, covered outdoor parking, and secured indoor parking
  - Policies that permit bikes on trains and buses, even during peak times
  - Bike rental or sharing programs located in or near train or bus stations
  - Channels or ramps on stairways that make it easier to use steps while pushing a bike
  - Public taxis with quick-mount bike racks for passengers

Education

- **Many of the foreign hosts have pervasive and widespread traffic safety education programs for children.** The education programs start at an early age and some continue through the teenage years. These traffic safety programs involve participation of a wide variety of organizations, including schools, businesses, civic organizations, police, public health groups, and parks and recreation departments. For example, several countries had a Children's Traffic Club program that provided ongoing, age-appropriate safety material to parents and children, as well as fun learning activities. The city of Winterthur, Switzerland, uses a "traffic garden" (a landscaped, reduced-scale closed course that includes traffic signals, roundabouts, bike lanes at intersections, sidewalks, work zones, public benches, and other common traffic situations) to teach elementary school-age children to ride bikes safely in traffic.

- **Bicycle helmet use is encouraged, but not required by law.** The scan team found higher levels of bicycle helmet use than expected in the countries visited. Helmets were uniformly encouraged for children and adults. Most countries emphasized physical activity first and helmets second. Their rationale was that required helmet use discourages bicycling (physical activity), which could have a greater public health detriment than head injuries due to crashes. Bicycle helmet use was recognized not as a crash-prevention measure, but as the most effective countermeasure for preventing head injury from a bicycle crash.

Enforcement

- **The scan team observed the widespread use of photo enforcement for traffic signals and speed limits.** Although photo enforcement is viewed primarily as a tool for improving motor vehicle safety, better motorist compliance with speed limits and traffic signals also improves pedestrian and bicyclist safety.

Encouragement

- **Many of the foreign hosts use promotional programs and activities to encourage and enable more walking and biking.** These encouragement activities are seen as a tool to meet their modal share goals as well as increase pedestrian and bicyclist safety. Many foreign hosts viewed higher levels of walking and biking as a way to improve safety (the "safety in numbers" effect). Where walking and bicycling are considered the norm, a certain amount of encouragement happens inherently, by example. Common examples of promotional programs and activities include the following:
  - Well-marked routes with wayfinding signs and printed maps
  - Web-based biking and walking route planning and maps, including extensive countryside pathways inviting tourists and other occasional users
  - Shared bike programs for public agencies, private companies, or the general public
  - Free or very low-cost public-use bicycles
  - Routine provision of quality bike racks at convenient locations
  - Employer-sponsored programs (bike-to-work incentives)
  - Marketing campaigns to reduce or shift short car trips
  - Public health-sponsored wellness and physical activity programs
  - Personalized travel planning

Evaluation

- **Many of the foreign hosts provide regular performance reports on pedestrian and bicyclist safety and mobility.** These performance reports measure the agency's progress toward stated goals and outcomes, and are used to refine policies and strategies to ensure that goals are met. For example, the city of Copenhagen publishes a Bicycle Account every 2 years that reports on several measures, such as cyclist mode split, safety, and perceived comfort and safety. The most common pedestrian and bicyclist performance measures were usage (e.g., counts, mode share) and safety (e.g., fatalities and serious injuries), which were typically reported on an annual basis.

- **Several cities provided a "showcase" counter in a highly visible location to demonstrate daily and annual bicycle use.** Although this tool was noted to yield varying and, in some cases, inaccurate results, it was a point of pride and a reminder that what gets counted counts.

Implementation Plan

Based on the findings summarized in this report, the scan team developed the following implementation recommendations.

Policy

- **Encourage transportation policy (at national, State, and local levels) that addresses the safety and mobility of walking, biking, and other nonmotorized modes so that these modes are given the highest priority in the road user hierarchy.** This hierarchy, when integrated with public transit, simultaneously addresses numerous other public policy goals, such as livability, sustainability, public health, climate change, and congestion management. To implement this policy, establish specific and measurable outcomes with performance targets, including usage and safety experience (see the "Evaluation" recommendation in this section). Specific near-term actions include the following:

- Revising, strengthening, and publicizing the U.S. Department of Transportation (U.S. DOT) policy statement Accommodating Bicycle and Pedestrian Travel: A Recommended Approach
- Conducting a survey of domestic and international best practices related to policies that facilitate safety and increased rates of walking and bicycling. Such policies should be examined at Federal, State, and local levels. Examples include Complete Streets policies in the United States, the national bicycling plan for Germany, the United Kingdom Cycling City program, and Swiss legislation on human-powered mobility.
- Developing a national strategy to improve education for transportation professionals on walking and bicycling design and planning
- Completing a new *National Bicycling and Walking Study* that will set new mode share and safety targets for walking and bicycling

Engineering

Evaluate and consider implementing innovative signal features and geometric designs to improve pedestrian safety at street crossings. Examples of pedestrian features that can be implemented now are as follows:

- Raised crosswalks at pedestrian crossings (applied at midblock and roundabouts)
- Passive detection of pedestrians in waiting areas and crosswalks to extend or cancel pedestrian phase
- Accessible pedestrian signals with confirmation lighting
- Crossing islands at pedestrian crossings, even on narrow roadway widths
- Partial crossings at wide signalized intersections with wide medians (additional push buttons and pedestrian signals will be required)

Examples of pedestrian features that could be implemented in the short term with appropriate evaluation are as follows:

- Near-side pedestrian signal heads that encourage viewing oncoming traffic
- Passive detection of pedestrians in waiting areas and crosswalks to truncate the pedestrian phase

Evaluate and consider implementation of innovative strategies to improve bicyclist safety. Examples of bicyclist features that can be implemented now are as follows:

- Convex mirrors
- Right-turn-on-red car restrictions
- Advance stop lines for bicyclists
- Continuation of bike lanes up to intersections
- Bike lanes between traffic lanes
- Shared bike lanes and right-turn lanes
- Bike routes on lower volume parallel roadways
- Contraflow bicycle lanes
- Path user divisions
- Dashed bike lanes through intersections
- Rotated or longitudinal bicycle symbols at driveways

Examples of bicyclist features that would likely require evaluation are as follows:

- Cycle tracks
- Accommodating two-stage left turns at signalized intersections
- Dashed bicycle lanes on narrow roadways
- Railing separating pedestrians and bicycles at intersections
- Colored lanes at conflict points
- Reserving yellow for bicycle and pedestrian pavement markings

Evaluate the applicability of lower speed street designs in residential and commercial zones. The evaluation should address the differences in application between residential and commercial areas, and should more clearly define implementation issues and application criteria for the design of low-speed streets in the United States that are practical, safe, and efficient for all road users.

Develop guidance on best practices for integrating bicycle and pedestrian considerations into public transit, including intercity rail. These considerations include permitted times of bike boarding, bike parking, bikes on trains and buses, and bike sharing (e.g., city bike) programs. Two existing documents may partially address this need: *Transit Cooperative Research Program Synthesis 62–Integration of Bicycles and Transit* (2005) and *Pedestrian Safety Guide for Transit Agencies* (FHWA-SA-07-017). Based on a review of these documents, a best practices guide may be desirable that includes any strategies observed during the scan that were not part of the two reports. Once a suitable guide has been identified or developed, Web conferences and other training should be provided to transportation and transit engineers and planners.

Education

- **Institutionalize ongoing traffic safety education that starts at an early age, including knowledge and skill-based learning.** The safety education programs can be multifaceted and include a variety of agencies and organizations for optimal delivery. To accomplish this, a national set of bicycle and pedestrian education standards and curriculum should be developed that establishes the minimum amount of information to be included and at what ages. The curriculum should incorporate practical applications of this safety information in safe settings, such as a mock pedestrian crossing or the traffic garden concept.

- **Unify traffic safety campaigns (including bicycle and pedestrian safety) under a single national brand.** For example, the United Kingdom's Department for Transport has developed a road safety program called THINK! that includes educational materials for numerous safety focus areas. To accomplish this, the U.S. DOT should develop a single brand and require that it be included on all highway safety educational and communication materials it produces. U.S. DOT highway safety materials are disseminated through a wide number of partners, including national associations, State and local governments, law enforcement agencies, medical organizations, public health departments, vehicle manufacturers, and insurance companies.

Enforcement

- **Promote the use of photo enforcement as a tool to improve pedestrian and bicyclist safety.** The Federal Highway Administration (FHWA) and National Highway Traffic Safety Administration (NHTSA) already promote photo enforcement. Their Web sites (see http://safety.fhwa.dot.gov/index.cfm and http://safety.fhwa.dot.gov/speedmgt) have extensive information on implementing speed and red light running campaigns.

Encouragement

- **Develop and implement programs that encourage and enable regular walking and biking.** Examples of these strategies include the following:
  - Web-based route planning
  - Walking and biking maps
  - Social marketing campaigns
  - Shared-bike programs for the public or municipal employees

Evaluation

- **Develop and implement a performance monitoring and reporting program that annually measures progress toward stated goals and outcomes.** Key performance measures are usage and safety experience. Other measures include pedestrian and bicyclist facility condition and extent (e.g., mileage). Existing count and safety evaluation efforts (Alliance for Biking and Walking's *Bicycling and Walking in the U.S. Benchmarking Report,* Alta/Institute of Transportation Engineers National Bicycle and Pedestrian Documentation Program, FHWA's *National Bicycling and Walking Study*) should be better coordinated and unified. National guidance should be given on a consistent format and a sampling strategy to develop national estimates. Additionally, the 1994 *National Bicycling and Walking Study* should be updated to reflect current conditions and renew or reestablish national goals for bicycling and walking safety and usage.

Next Steps

As evidenced in this report, the scan team identified numerous approaches in the host countries for improving walking and biking safety and mobility that merit consideration in the United States. The next critical step in FHWA's International Technology Scanning Program is the implementation phase, which has already begun. Scan team members will communicate the key findings, promote implementation ideas, and help advance the adoption of the approaches and practices described in this report. Ultimately, though, the scan team will rely on champions from numerous agencies, organizations, and groups throughout the United States to put into practice policies and approaches that will ultimately increase the safety of walking and bicycling and the use of walking and bicycling for transportation.

CHAPTER 1

Introduction

In May 2009, a team of 12 transportation professionals from the United States with expertise in bicycling and walking visited five countries in Europe (table 1) to identify and assess effective approaches to improve pedestrian and bicyclist safety and mobility. The countries were chosen because of their innovative approaches to nonmotorized transportation, as well as the potential transferability of their policies and practices. Some, like Denmark, had experienced an increase in car use in the 1960s and 1970s, and subsequently reoriented their transportation policy to give priority to bicycling and walking. The scan team heard presentations from and had informal discussions with the foreign hosts. During most visits, the scan team also went on guided field visits (by bike as well as by foot) to better understand and experience the design and operation of various walking and bicycling facilities. These field visits were invaluable in documenting the facilities through photos and video, observing traffic behavior, and experiencing firsthand how well a design or operational strategy worked.

Table 1. *Hosted locations for the pedestrian and bicyclist safety and mobility scanning study.*

Countries Visited	Localities Visited
Sweden	Lund and Malmö
Denmark	Copenhagen and Nakskov
Germany	Berlin and Potsdam
Switzerland	Bern and Winterthur
United Kingdom	London and Bristol

The scan team identified numerous possible approaches to improving pedestrian and bicyclist safety and mobility in the United States. The scan team also prepared a list of implementation items for approaches that should be pursued in the United States. An executive summary (released June 24, 2009) provided a quick-response overview of the team's findings and recommendations. This final report describes the scan team's findings and recommendations in more detail.

Background

There is increasing recognition of the need to improve pedestrian and bicyclist safety. In 2008, the United States had 4,378 pedestrian and 716 bicyclist deaths, accounting for 14 percent of all U.S. highway fatalities. The Federal Highway Administration's (FHWA) Office of Safety has established pedestrian and bicyclist safety as one of its top priorities. Two other priorities, intersection safety and speed management, are issues that also significantly affect pedestrians and bicyclists. The American Association of State Highway and Transportation Officials (AASHTO), an association of State transportation departments, has identified two of the top 10 goals in its Strategic Highway Safety Plan as "making walking and street crossing safer" and "ensuring safer bicycle travel."

FHWA has recently launched two new programs targeted at increasing pedestrian and bicyclist travel and improving safety. Safe Routes to School is a $612 million national program with the majority of funds devoted to infrastructure improvements. The Nonmotorized Pilot Program, which provides $100 million to four communities to improve bicycling and walking facilities, aims to evaluate how improved walking and biking facilities can carry a significant portion of the urban transportation load.

Purpose and Objectives

The purpose of this scanning study was to identify and assess effective approaches to improve pedestrian and bicyclist safety and mobility. The specific topics of interest were the following:

- **Improving pedestrian and bicyclist safety**—Approaches (engineering, education, and enforcement) that have been successful in improving pedestrian and bicyclist safety. These approaches can include both infrastructure and policy.
- **Safe Routes to School programs**—Approaches and policies for improving safety for child pedestrians and bicyclists, especially those that support programs like Safe Routes to School
- **Monitoring usage levels and exposure**—Quantitative methods of monitoring pedestrian and bicyclist usage

levels (for example, counts and surveys) and exposure to crashes

- **Safety research and evaluation**—Recently completed or ongoing research and collaboration opportunities in pedestrian and bicyclist safety

Amplifying questions (see Appendix A) on these topic areas were sent in advance to each host country. The amplifying questions informed the hosts about the scan team's focus areas and provided some structure to host country presentations and discussion.

Host Country Information

Over the course of 2 weeks, the scan team met with national and local officials in 10 cities in five host countries (see table 1). A travel itinerary and meeting schedule is in Appendix B. A list of contact persons for each host agency is in Appendix C.

Scan Team Members

The 12 scan team members (see figure 1) represented Federal agencies, State departments of transportation (DOTs), metropolitan planning organizations (MPOs), research agencies, and a professional organization:

- **Edward L. Fischer** (AASHTO cochair), Oregon DOT
- **Gabe K. Rousseau** (FHWA cochair), FHWA
- **Shawn M. Turner** (report facilitator), Texas Transportation Institute
- **Ernest (Ernie) J. Blais,** FHWA Vermont Division
- **Cindy L. Engelhart,** Virginia DOT
- **David R. Henderson,** Miami-Dade County MPO
- **Jonathan (Jon) A. Kaplan,** Vermont Agency of Transportation
- **Vivian M. (Kit) Keller,** Association of Pedestrian and Bicycle Professionals (APBP)
- **James Mackay,** Bicycle Technical Committee, National Committee on Uniform Traffic Control Devices
- **Priscilla A. Tobias,** Illinois DOT
- **Diane E. Wigle,** National Highway Traffic Safety Administration (NHTSA)
- **Charlie V. Zegeer,** University of North Carolina Highway Safety Research Center

Contact and biographical Information for the scan team members is in Appendix D.

Figure 1. *Pedestrian and bicyclist safety and mobility scan team (front row, left to right: Charlie Zegeer, Shawn Turner, Kit Keller, Priscilla Tobias, Diane Wigle, Cindy Engelhart; back row, left to right: David Henderson, Jon Kaplan, Ernie Blais, Ed Fischer, James Mackay, Gabe Rousseau).*

Report Organization

The purpose of this report is to provide a summary of various innovative approaches that other countries have used to improve pedestrian and bicyclist safety, as well as to recommend specific implementation elements that are most likely to improve the safety and mobility of pedestrians and bicyclists in the United States.

Chapter 2 provides a discussion of the broad issues and themes that emerged on the scan and provides a context for understanding the details provided in later chapters of the report.

Chapters 3 through 8 have been organized around a familiar categorization—the 3Es: Engineering, Education, and Enforcement—but it has been expanded to include two additional Es, Encouragement and Evaluation.

- **Chapter 3** contains information on engineering and facility design topics.
- **Chapter 4** addresses safety education.
- **Chapter 5** includes enforcement approaches.
- **Chapter 6** discusses the encouragement and promotion of walking and biking as sustainable travel modes.
- **Chapter 7** includes information on the evaluation of walking and biking programs (such as monitoring and reporting usage and progress toward policy goals).
- **Chapter 8** provides the scan team's recommendations and implementation plan.

CHAPTER 2

Comprehensive Approach to Pedestrian and Bicyclist Safety and Mobility

Improving pedestrian and bicyclist safety and mobility in the United States requires a comprehensive approach that includes numerous groups working toward solutions from several different angles. This chapter outlines the elements of a comprehensive approach, provides a discussion of the broad issues and themes that emerged on the scan, and provides a context for understanding the details in later chapters of this report.

Policies and Factors Influencing Pedestrian and Bicyclist Safety and Mobility

From all of the information that the scan team gathered and everything it observed, it appears that higher levels of walking and biking safety and mobility are due to a deliberate combination of policies, approaches, and other influences that include the following:

- Integration of transportation and land use policy
- Transportation planning and design policies that are mode neutral or that give priority to vulnerable road users (like pedestrians and bicyclists)
- Political support at all levels, including elected officials, government staff, and the general public
- Provision and pricing of motor vehicle parking
- The high costs of owning and operating a private motor vehicle (sales tax, annual registration fees, gas, parking, fines for moving violations, etc.)
- A comprehensive, continuous, integrated approach that includes elements such as the following:
    - Integration with and widespread availability of public transit
    - Connected onstreet and offstreet walking and biking networks
    - Ongoing promotional campaigns and activities
    - Traffic safety education for children throughout their school years
    - Visually rich, pedestrian-scale built environment
    - Prohibition against right turn on red except where specifically permitted
    - Routine photo enforcement
    - Numerous other policy and facility details that make walking and bicycling easy, convenient, and enjoyable

This comprehensive approach extends beyond simply providing engineering treatments or innovative facilities for pedestrians and bicyclists. From the scanning study, it appeared that facilities could increase levels of walking and biking as well as improve safety. For example, studies in Copenhagen[1] indicate that bicyclist levels increase by about 20 percent when new cycle tracks (bikeway facilities that provide separation from motor vehicles, see Chapter 3) are built. However, many of the foreign hosts indicated that facilities were only one necessary element of a comprehensive approach.

In Switzerland, the hosts described examples of their land use policy that favored transit and bicycle use. The policy for new development was that it must occur along corridors with existing or planned transit service or bicycle routes. Exceptions to this policy are considered on a case-by-case basis by the city government or regional planning authority.

In Copenhagen, the city government has adopted several different policies (see figure 2) that contribute to higher levels of walking and bicycling and, as a result, improved safety for pedestrians and bicyclists. For example, Copenhagen has policies that limit automobile parking (through prices and availability) in the inner city and surrounding areas. Through various policies, the city government has encouraged urban workplaces to be located close to major public transit stations. A low emissions zone has been established in Copenhagen in which new policies seek to reduce particulate matter by 80 percent. The city has also placed a restriction on large trucks (heavier than 18 tons) in and around the city center. The city and national governments are considering a congestion charging zone proposal

[1] *Copenhagen 2006 Bicycle Account*, www.kk.dk/Borger/ByOgTrafik/cyklernesby/uk/bicycleaccount2006.aspx.

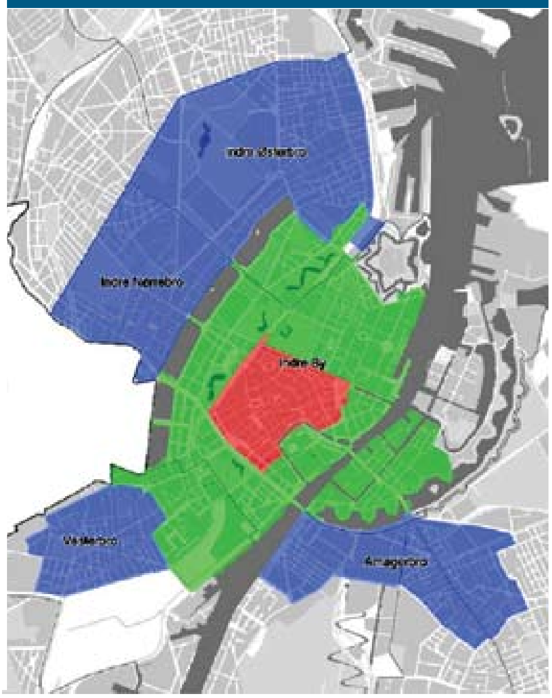
for Copenhagen that would charge motorized vehicles 3 Euros (about US$4.25) for passage during peak times (the charge would be 1.5 Euros, or about US$2.13, for daytime hours with free passage at night).

Many of the foreign hosts have established an urban street user hierarchy that gives the highest priority to walking, biking, and public transit. The street user hierarchy has been developed to support a range of public policy goals, such as livability, sustainability, public health, climate change, and congestion management. The hierarchy guides decisions about transportation policy, planning, design, operations, and maintenance. For example, typical street design begins by considering the space needs of pedestrians and bicyclists first, rather than designating the motor vehicle space and then giving pedestrians and bicyclists the leftover space (if there is any). Another example from Lund, Sweden, is its winter snow removal policy, which gives highest priority to streets with transit routes and bicycling facilities.

In several host cities, walking and biking were viewed not only as a transportation issue or solution, but also as a solution to multiple public policy goals, such as improved public health, improved sustainability and energy efficiency, reduced climate change, and increased tourism and economic development. The many policies that supported walking and biking reflected the widespread political support and recognition that walking and biking contribute more than just replacement of a car trip.

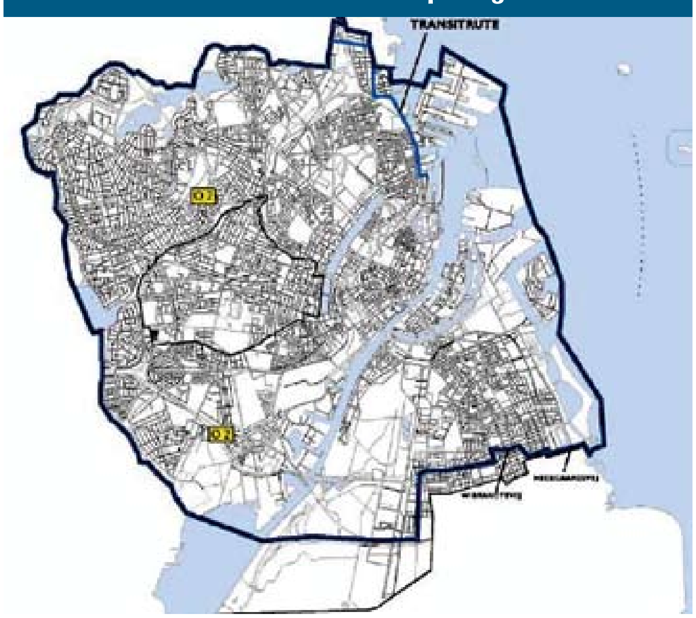
In several host cities, political support at various levels was clear and evident. In these cities, it was not just the city staff and biking and walking advocates who promoted biking and

Parking pricing zones in Copenhagen



SOURCE: PRESENTATION BY STEFFEN RASMUSSEN, CITY OF COPENHAGEN

Low-emissions zone in Copenhagen



Proposed congestion pricing zone in Copenhagen

Figure 2. *Several land use and transport policies influence walking and biking in Copenhagen, Denmark.*

walking; it was also the elected officials and key policymakers (see figure 3), city council, public works department manager and staff, tourism and economic development bureaus, and general public. For example, in Winterthur, Switzerland, city government and the general public have consistently supported walking and bicycling, even at the ballot box. In 1955, motor vehicle traffic was restricted from the main street (Untertor/Marktgasse) through the historic city center. In 1973, by popular vote, motor vehicle traffic was prohibited from the entire historic city center. In 1983, popular vote approved the "Netzkonzept 100km," a 100-kilometer (km) (62.1-mile (mi)) bicycle route network. The late 1980s and 1990s saw several more iterations of bicycle route plans and pedestrian improvements. Most recently, in May 2009, an overwhelming majority of Winterthur voters (67 percent) approved an extensive streetscape project (with numerous pedestrian and bicyclist elements) near the city's main train station worth 84 million Swiss francs, or about US$78 million.

Historical Perspective and Changes in Policies and Culture

The host cities the scan team visited have not always had this ideal combination of policies and influences for walking and biking. In fact, many European cities experienced a decline in walking and biking in the late 1960s and early 1970s (see figure 4 on next page). Several host agencies described a key turning point in the early 1970s, when a consensus emerged from the general public and elected officials that transportation policies that excessively favored the private automobile needed to change. Therefore, what the scan team saw in several of the host cities is the cumulative effect of 30 to 40 years of experience and culture change with transportation and land use policy and infrastructure design supportive of walking and biking.

The foreign hosts provided several before-and-after photos as tangible examples of streets, plazas, and other public places transformed by policies that restricted automobile use and favored walking, biking, and transit modes. For example, the Strøget area is Copenhagen's main pedestrian shopping area and includes several streets on which motor vehicles are prohibited. Strøget was created in the 1960s when cars were beginning to dominate Copenhagen's central city streets. City leaders wanted to ensure that some areas remained car free. Strøget is said to be the longest pedestrian shopping area in Europe, and is believed to be the inspiration for numerous other pedestrian streets and shopping areas. The left photo in figure 5 (see next page) shows Strøget before cars were prohibited, and the right photo shows Strøget in its current state as a vibrant pedestrian district.

SOURCE: PRESENTATION BY STEFFEN RASMUSSEN, CITY OF COPENHAGEN, DENMARK

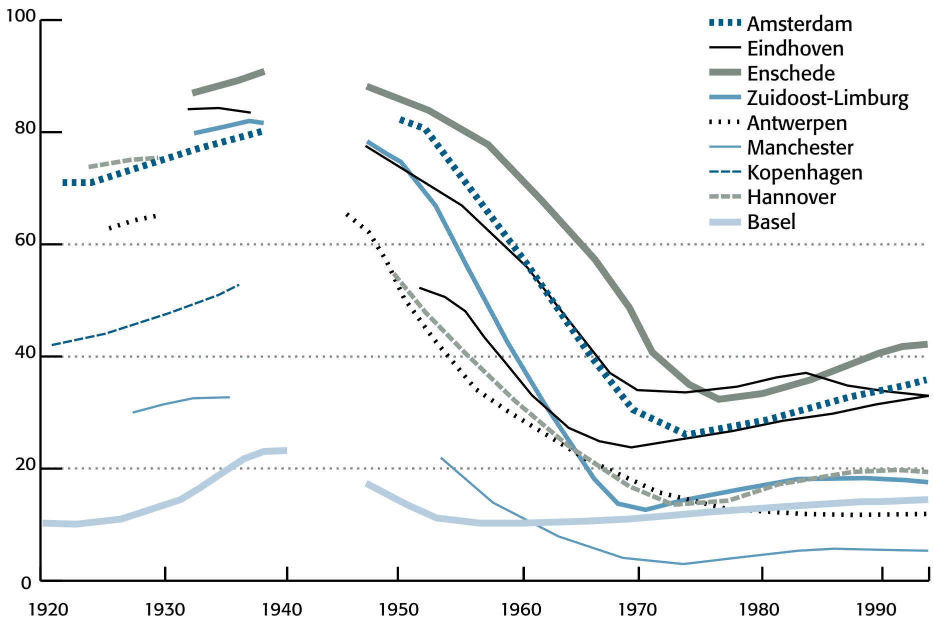
Figure 3. *Deputy mayor of Copenhagen encourages commuter bicyclists with breakfast bagels.*

As mentioned earlier, Winterthur has been making pedestrian improvements to its historical city center since 1955. The improvements started as motor vehicle restrictions on a single street and over the course of 50 years (see figure 6 on page 15) extended to 15 hectares (37 acres, or 1.6 million square feet) of a pedestrian-priority zone (the largest interrelated pedestrian zone in Switzerland). A city streetscape project was approved in May 2009 that would enlarge this pedestrian zone by 22 hectares (54 acres) for a total pedestrian-priority zone of 37 hectares (91 acres, or about 4 million square feet) around the historical city center and main train station. A before-and-after example for one street (Neumarkt) is shown in figure 7 (see page 16). In this example, a surface parking lot was converted to a plaza for outside café dining and an open-air market.

The historical city center of Bern, Switzerland, has experienced similar transformations in the past 30 to 40 years (see figure 8 on page 16). For example, a surface car parking lot in front of the Bundeshaus (the Swiss Federal Assembly Building) was converted to a public plaza with intermittent in-pavement public fountains. According to the Bern hosts, the plaza is quite crowded with pedestrians during the summer. At other times of the year, the Bundeshaus plaza is used for open-air markets, holiday decorations (including a lighted Christmas tree), and ice skating.

Safety in Numbers

The theory of "safety in numbers" (also called "awareness in numbers") is a clear motivator behind the promotion of



SOURCE: *CONTINUOUS AND INTEGRAL: THE CYCLING POLICIES OF GRONINGEN AND OTHER EUROPEAN CYCLING CITIES*[2]

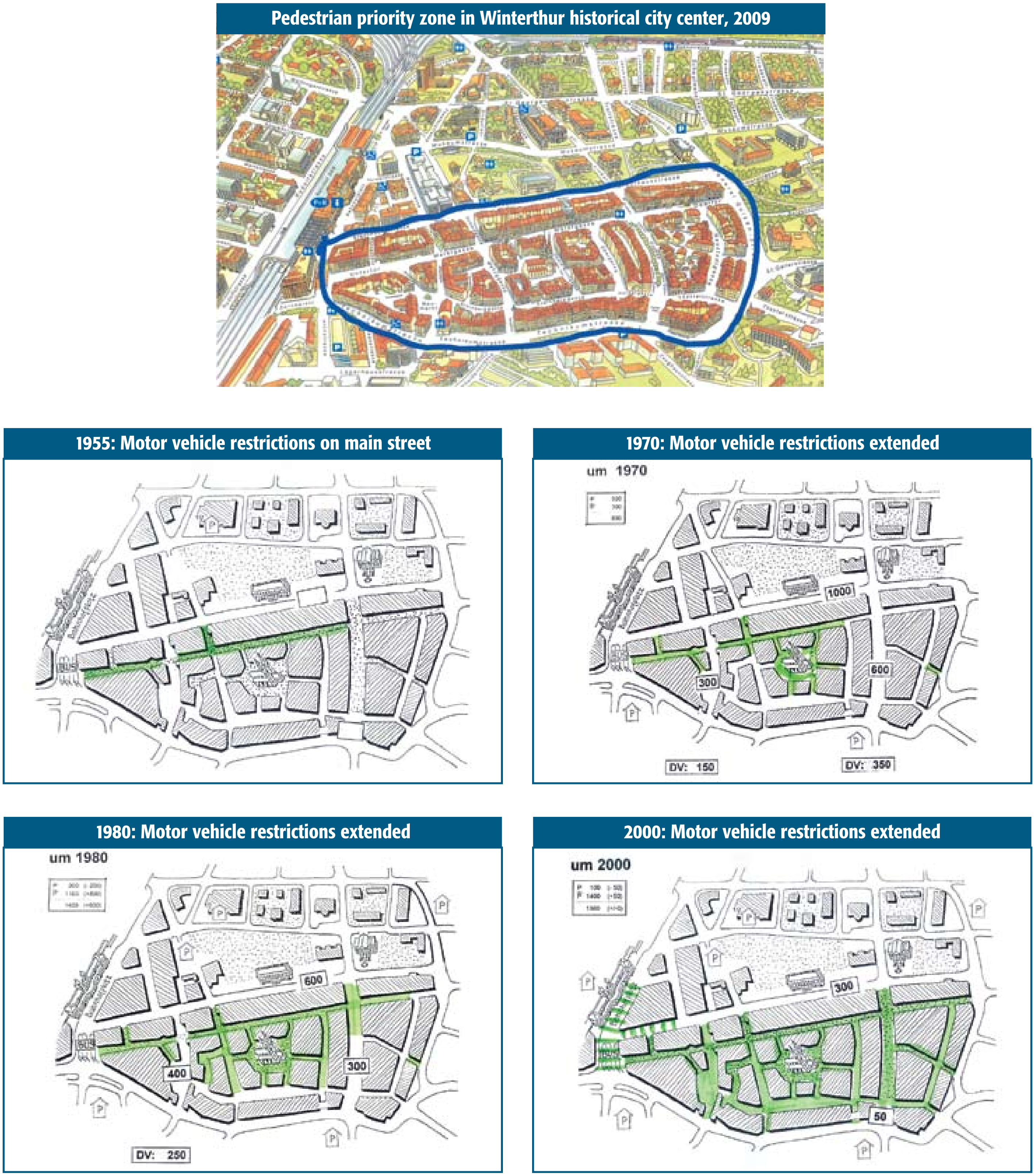
Figure 4. *Historical bicycle mode share in several European cities.*

SOURCE: JAN GEHL AND LARS GEMZØE, *NEW CITY SPACES*, 2000

Figure 5. *Before-and-after photos of Strøget in Copenhagen.*

walking and bicycling as a safety improvement strategy. Most of the host countries indicated that they promoted walking and bicycling for a variety of reasons (lower overall transportation delivery cost, sustainability, space and energy efficiency, health and wellness, etc.), and improved safety was often mentioned as one of the outcomes of higher levels of walking and biking. Their rationale is that when pedestrians and bicyclists are a common element in the street environment, motorists are more likely to expect their presence and take the necessary precautions at potential conflict points, such as when a motorist turns right across a through bicycle lane. Anecdotally, the scan team routinely observed this type of motorist behavior during field visits, in which motorists were more aware of pedestrians and bicyclists at conflict points (see figure 9 on page 17). However, it is not clear whether this improved motorist awareness was due primarily to the increased numbers of pedestrians and bicyclists, or due at least in part to improved roadway designs, motorist education, and/or police enforcement.

[2] Available at www.fietsberaad.nl/library/repository/bestanden/Publication%207%20Continuous%20and%20integral.pdf.



SOURCE: PRESENTATION BY STEFAN GERBER, CITY OF WINTERTHUR, SWITZERLAND

Figure 6. *Historical development of a pedestrian priority zone in Winterthur, Switzerland.*

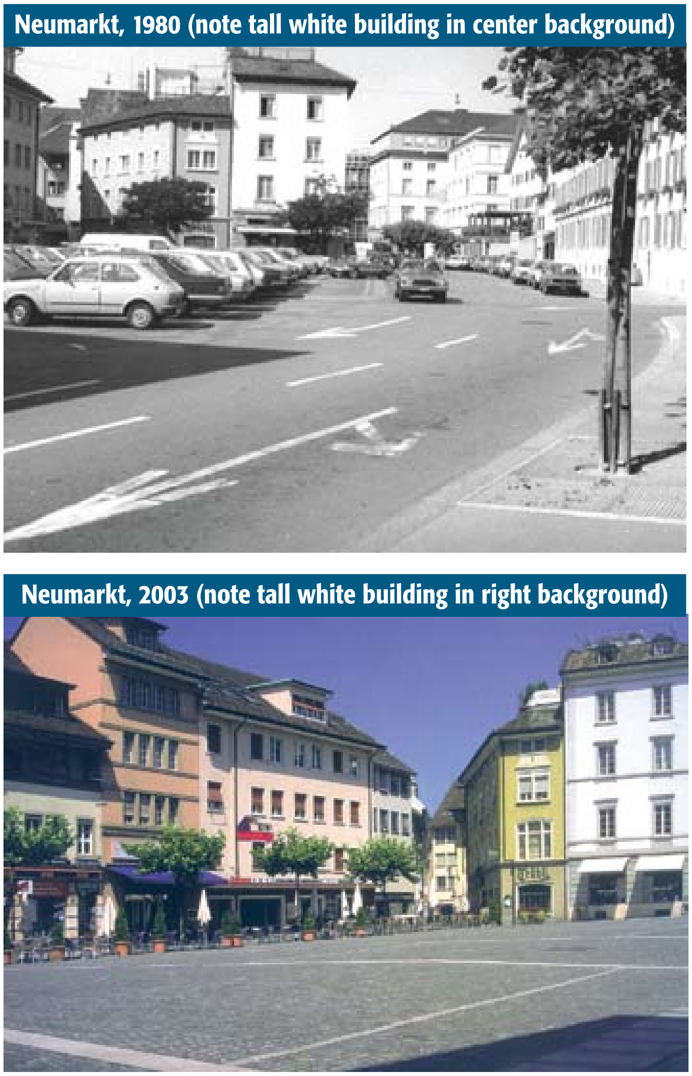


Figure 7. *Before-and-after photos of pedestrian priority zones in Winterthur, Switzerland.*

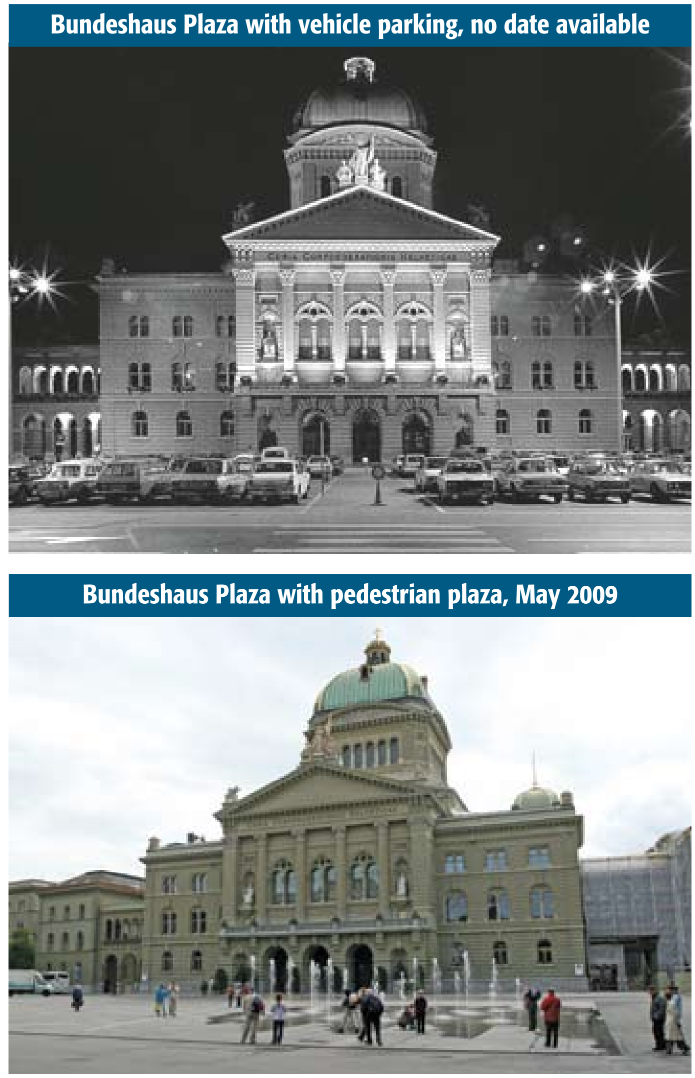


Figure 8. *Before-and-after photos of public plaza in front of the Bundeshaus in Bern, Switzerland.*

Key Findings

The key findings on a comprehensive approach for pedestrian and bicyclist safety and mobility were as follows:

- **Numerous factors contribute to higher rates of pedestrian and bicyclist safety improvements and higher walking and biking mode splits in the host countries.** From all of the information the scan team gathered and everything it observed, it appears that higher levels of walking and biking safety and mobility are due to a deliberate combination of policies, approaches, and other influences.

- **The host cities the scan team visited have not always had this ideal combination of factors and influences for walking and biking.** In fact, many European cities experienced a decline in walking and biking in the late 1960s and early 1970s. Several host agencies described a key turning point in the early 1970s, when a consensus emerged from the general public and elected officials that transportation policies that excessively favored the private automobile needed to change. Therefore, what the scan team saw in several host cities is the cumulative effect of 30 to 40 years of experience and culture change with transportation and land use policy and infrastructure design supportive of walking and biking.

- **Many of the foreign hosts have established an urban street user hierarchy that gives the highest priority to walking, biking, and public transit.** The street user

Figure 9. *Motorist waits for through bicyclists before turning right across cycle track in Copenhagen, Denmark.*

hierarchy has been developed to support a range of public policy goals, such as livability, sustainability, public health, climate change, and congestion management. The hierarchy guides decisions about transportation policy, planning, design, operations, and maintenance. For example, typical street design begins by considering the space needs of pedestrians and bicyclists first, rather than designating the motor vehicle space and then giving pedestrians and bicyclists the leftover space (if there is any). Another example from Sweden is its winter snow removal policy, which gives highest priority to streets with transit routes or bicycling facilities.

- **"Safety in numbers" (also called "awareness in numbers") is a clear motivator behind the promotion of walking and bicycling as a safety improvement strategy.** Most host countries indicated that they promoted walking and bicycling for a variety of reasons (lower overall transportation delivery cost, sustainability, space and energy efficiency, health and wellness, etc.), and improved safety was often mentioned as one of the outcomes of higher levels of walking and biking. Their rationale is that when pedestrians and bicyclists are a common element in the street environment, motorists expect their presence and take the necessary precautions at potential conflict points, such as when a motorist turns right across a through bikeway.

CHAPTER 3

Engineering and Design Elements

In the context of this report, engineering means designing and building infrastructure (streets and other public spaces) that is safe, convenient, accessible, and comfortable for pedestrians and bicyclists to use. Infrastructure and facilities (e.g., sidewalks, bikeways, and trails) are often the most visible element of government support for walking and biking modes. Similarly, adequate facilities are often mentioned as a required element for those who do not walk or bike. This chapter highlights numerous examples of street design and engineering that the scan team noted during the scanning study as conducive to pedestrian and bicyclist safety and mobility.

Implementing Foreign Design Practices in the United States

Some policies, practices, and designs are easily transferrable and can be immediately implemented. However, implementing some foreign policies and design practices in the United States may require a safety evaluation and/or implementation criteria. For example, separated bicycle facilities should be evaluated in the context of typical motorist and bicyclist behavior and safety experience in the United States before being widely implemented. Separated onroad bicycle facilities may be quite effective in Denmark, for example, but their effectiveness may be at least partly a product of Danish culture and behavior or a result of their widespread implementation.

However, foreign practices (like separated bicycle facilities) should not be dismissed outright simply because current American culture and behavior may be different. Culture and behavior can be changed, but these changes often occur over longer time periods than covered in a typical safety evaluation. For example, separated bicycle facilities could be evaluated at a few trial locations in the United States and show no clear safety benefits in a typical 1- to 2-year safety evaluation. But in 5 to 10 years, as more bicyclists use separated facilities and motorist and bicyclist behavior adapts, safety could improve dramatically. Unfortunately, this increase in safety would not be captured in typical safety evaluations because they do not capture long-term behavior changes. Many of the host countries have undergone a culture change over the past 40 years that has returned to an increased emphasis on walking and bicycling safety and mobility. Changes of this sort can happen if fostered by a careful, evidence-based approach.

False Sense of Security and Safety

The foreign hosts gave thoughtful consideration to a "false sense of security and safety" when designing pedestrian and bicyclist facilities. This expression was mentioned numerous times by the engineers and planners responsible for facility design details. The host countries are not rashly constructing facilities in an effort to promote walking and bicycling without regard for safety. In fact, some host countries are paying meticulous attention to crash and injury data to determine which road designs are safest for pedestrians and bicyclists. For example, Sweden has implemented nationwide the STRADA (Swedish Traffic Accident Data Acquisition) database that integrates police crash data and hospital admissions data. The STRADA database addresses the underreporting problem common to walking and biking, and gives Swedish engineers and planners a more complete picture of walking and biking safety.

Engineering and Design Elements for Pedestrians

The scan team observed several innovative traffic signal features and design practices that have the potential to improve pedestrian safety in the United States. This section highlights numerous examples of engineering and design elements for pedestrians that are not commonplace in the United States.

PUFFIN Crossing

The PUFFIN (**P**edestrian **U**ser-**F**riendly **In**telligent) crossing is the newest type of pedestrian traffic signal in the United Kingdom and includes several design features intended to improve pedestrian safety:

- Near-side pedestrian signal head (figure 10, see next page) that encourages pedestrians to view oncoming traffic

- Simplified pedestrian signal phasing that includes "green man" (walk) and "red man" (don't walk) phases, but eliminates a flashing "don't walk" (i.e., don't start) phase
- Passive detection of pedestrians (figure 11) in crosswalks, waiting areas, and landings to truncate, extend, or cancel the pedestrian phase at traffic signals
- An indicator light that confirms when the pedestrian signal has been activated
- Tactile signal phasing indicators for visually impaired pedestrians

In the United Kingdom, PUFFIN crossings are being phased in to replace the typical pedestrian traffic signal, which is referred to as a PELICAN (**PE**destrian **LI**ght **C**o**N**trolled) crossing. A Department for Transport brochure indicates that the PUFFIN crossing has these benefits:

Safer for Pedestrians:

- The sensors that see you at a PUFFIN crossing also control the traffic lights.
- Because there is no flashing red traffic light sequence, drivers can no longer start to move until you have finished crossing.
- You can see the pedestrian signal and watch traffic approaching at the same time.
- Partially sighted pedestrians can see the near-side pedestrian signals more easily than a signal on the other side of the road.

Better for Drivers:

- Traffic lights change to green as soon as the crossing is clear, so drivers will no longer be stopped unnecessarily if there are no pedestrians in the road.
- Traffic won't be stopped if pedestrians push the button and then cross the road before the traffic lights change to red, or if they push the button, then change their mind and walk away from the crossing.

Offset or Staggered Pedestrian Crossing

The design of an offset or staggered pedestrian crossing places oncoming traffic in the crossing pedestrian's field of view so the pedestrian is more likely to notice it. Offset pedestrian crossings (figure 12) can be used at both signalized and unsignalized crosswalks. Depending on site conditions, the offset can be a right angle or skewed. The most important design feature is that the offset forces pedestrians to walk longitudinally in the median for a short distance so they face oncoming traffic.

Near-Side Traffic Signals

Near-side traffic signals for motor vehicles are common in all of the countries the scan team visited. The near-side traffic signals are mounted on cantilever support arms

Figure 10. *Near-side pedestrian signal with confirmation light in Bristol, United Kingdom.*

Figure 11. *Automated pedestrian sensors for adapting signal timing for pedestrians in Bristol, United Kingdom.*

Figure 12. *Offset pedestrian crossing at a signalized intersection in Bristol, United Kingdom.*

Figure 13. *Near-side traffic signals in Bern, Switzerland.*

(over the traffic lanes), as well as on shorter poles mounted on the side (and median, if present) of the street (figure 13). The foreign hosts indicated that near-side traffic signals are effective at reducing motorist encroachment on the pedestrian crosswalk. For example, at most intersections, motorists are unable to see the traffic signal if they stop too far forward in the pedestrian crosswalk. There was discussion that near-side traffic signals are more visible to approaching motorists and provide a visual target at the appropriate stopping point (before vehicles enter the intersection). There was also discussion that far-side traffic signals may actually induce more red-light running, since the visual target is on the far side of the intersection. The hosts did not provide any safety data on this topic, only anecdotal experience.

Raised Crosswalks

Research in Sweden by Ekman and others has concluded that raised crosswalks at unsignalized crossings can be more effective than other traffic control devices (like flashing beacons) because they control speed at the actual pedestrian crossing. Consequently, slowed vehicles are more likely to yield the right-of-way to crossing pedestrians. The scan team observed the use of raised crosswalks in several countries (they were most common in Sweden and the United Kingdom) at midblock locations, roundabouts (figure 14, see next page), and entrances to traffic-calmed districts. In Sweden, there has been some opposition from drivers of emergency response and other large vehicles (like buses and trucks) to the raised crosswalks on major arterial streets. A unique feature of the raised crosswalk in figure 14 is that drivers have to slow down to mount the crosswalk, but the slope is gradual so drivers are not jolted at slow speeds. This was done to address the concerns of large vehicle operators.

Crossing Islands

Crossing islands, used most often by pedestrians and sometimes by bicyclists, are a common design element in the United States, but the frequency of use appeared to be greater in Europe (especially in the United Kingdom and Sweden). Crossing islands (sometimes with internally illuminated bollards) appeared to be used more often, even when confined or limited street space required the use of smaller islands (figure 15, see next page). Most crossing islands were accessible to people using assistive devices for walking. Another common sight was the use of crossing islands at midblock locations without crosswalk markings.

Pedestrian Railing

Pedestrian railing was most common in the United Kingdom (figure 16, see next page), where it was used to direct pedestrian movements to preferred crossing locations at intersections and in median islands. It also offered a useful guide to pedestrians with visual disabilities. The railing appeared to be most common in areas with high pedestrian traffic (e.g., London).

Figure 14. *Raised crosswalk at two-lane roundabout exit in Malmö, Sweeden.*

Figure 15. *Median island with unmarked crosswalk in London, United Kingdom.*

Accessibility Features

Pedestrian walkways and plazas, particularly in Copenhagen, offered two smooth surfaces for pedestrians on foot or using assistive devices for walking (figure 17). This technique offers an option for communities seeking to incorporate historic surfaces such as cobblestone into their sidewalk system while complying with the Americans With Disabilities Act (ADA). Another practice observed in Copenhagen was a guide strip for wayfinding by pedestrians with visual disabilities that tracked through intersections and to the steps of important public buildings (figure 18). Scan team members also observed that truncated domes in Copenhagen were constructed of metal rather than rubber. The Swedish city of Malmö provided tactile diagrams of street crossings at several intersections (figure 19) that offered advance information for a safer crossing. In Bristol, United Kingdom, a tactile rotating knob (figure 19) was located on the bottom of near-side pedestrian signals to indicate when the crossing phase had started.

Engineering and Design Elements for Bicyclists

The scan team observed several innovative approaches and design practices that could be used to improve bicyclist safety in the United States. This section highlights numerous examples of engineering and design elements for bicyclists.

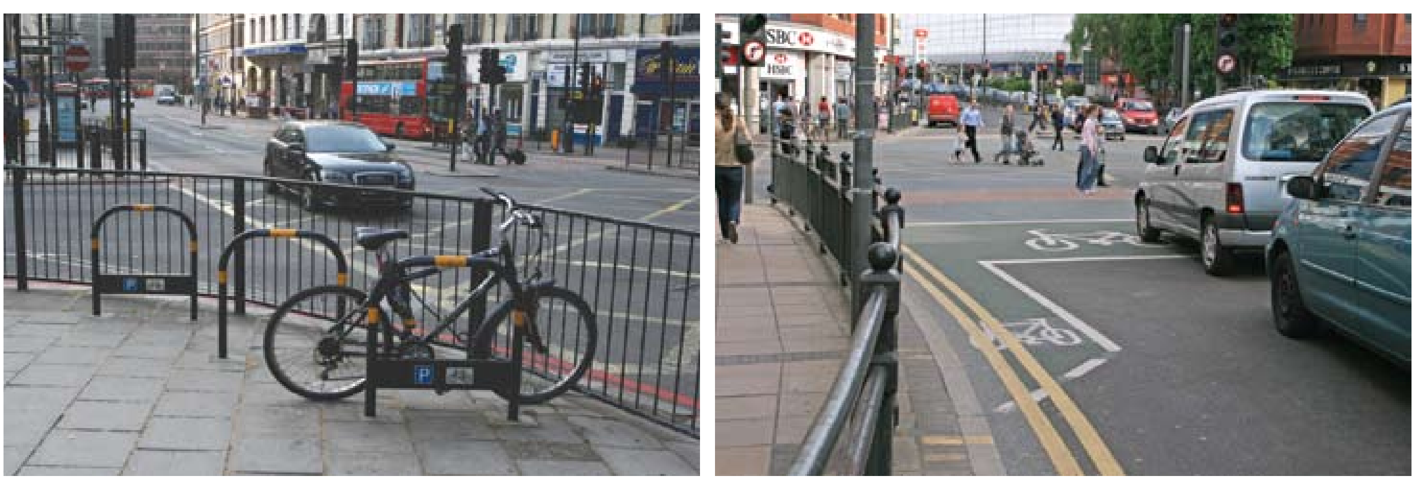


Figure 16. *Railing is used to direct pedestrians to preferred crossing locations in London, United Kingdom.*

Separated Facilities

Separated bicycling facilities were in use in all five of the countries visited during the scanning study. The designs differed between countries and sometimes at different locations within a country. For the purposes of this report, the separated bicycle facilities are classified into these categories:

- **Cycle track**—A one-way exclusive bike lane that is separated from motor vehicle traffic by a curb and has an elevation slightly above the motor vehicle lane but below the pedestrian walkway or sidewalk. Cycle tracks sometimes transition to onstreet bike lanes as they cross street intersections. Cycle tracks were most common in Copenhagen, Denmark (figure 20, see next page).

- **Cycle path**—A one-way or two-way exclusive bike lane located parallel to an existing street, but separated by a full-height curb. Cycle paths are typically at the same elevation as the pedestrian walkway or sidewalk, but are often differentiated by a distinct color. In some cases, the cycle path was located on the outside of onstreet parking or onstreet transit stops. The scan team saw numerous two-way cycle paths in Sweden and Switzerland (figure 21, see next page) and one-way cycle paths in Germany (figure 22).

- **Cycle path on an independent alignment**—A one-way or two-way bike path located on an alignment that is independent of the street network (figure 23, see page 25). When shared with pedestrians and other nonmotorized users, this path is comparable to a shared-use path in the United States.

Intersection Designs

Several different approaches were used to address bicyclist safety at intersections. The most common potential motorist-bicyclist conflict occurs when motorists turn right across a bikeway that goes through an intersection. Another potential conflict occurs when a bicyclist attempts to turn left across motorists traveling through an intersection.

Advance stop lines for bikeways were used in several of the host countries (figure 24, see page 25). At some intersections, the advance stop line was combined with a leading green phase for bicyclists. The advance stop line provides better visibility for bicyclists because they are positioned in front of turning motor vehicles at the intersection. The advance stop line and bicycle traffic signals also provide bicyclists with a physical and temporal head start, which

Figure 17. *Smooth, accessible path on cobblestone sidewalk in Copenhagen, Denmark.*

Figure 18. *Tactile sidewalk strips leading to front door of public building in Copenhagen, Denmark.*

Figure 19. *Intersection accessibility features for pedestrians with visual impairments.*

Figure 20. *Cycle track in Copenhagen, Denmark.*

Figure 21. *Two-way cycle path in Winterthur, Switzerland.*

Figure 22. *One-way cycle path in Berlin, Germany.*

permits through bicyclists to clear the intersection before motorists turn across the bikeway.

Large trucks often have blind spots along their front and side, and truck drivers have difficulty seeing bicyclists who may be in their path as they turn right across a bikeway. In Switzerland, engineers have developed a heated convex mirror (locally referred to as a "Trixi" mirror for a bicyclist crash victim) that is attached to a signal or utility pole at the intersection (figure 25). The convex mirror enables truck drivers to scan their blind spot before turning right across a bikeway. The bicyclist image size in the convex mirrors is still somewhat small and requires motorist awareness, especially for bicyclists in dark clothing or in low-light conditions. However, motorists' use of mobile phones and texting devices—a clinically proven distraction—is quite common in the United States and could reduce the effectiveness of the small bicyclist image size provided by convex mirrors. In the United Kingdom, the Department for Transport and other groups distribute an inexpensive Fresnel lens (called TruckView®) that can be attached to the side window of a truck to reduce the chance of a bicyclist being struck in a truck's blind spot.[3]

Bike boxes (also called "Dutch pockets" and enlarged bike lanes) are another intersection design element used in several countries (figure 26). The main benefit of a bike box is for left-turning bicyclists who arrive on a red signal phase to position themselves in front of motorists so they are more visible and can clear the intersection before motorists. Most bike boxes have a distinct color as well as a bicycle symbol on the pavement.

Most European traffic signal systems display a short simultaneous red and yellow indication before the green phase. This serves to alert queued traffic in advance of the green phase and alerts bicyclists that entering the bike box just before the green phase will likely result in a conflict with releasing traffic. There is no U.S. equivalent of the advance simultaneous red and yellow indication to provide a cue that the signal is changing.

Several U.S. cities are experimenting with bike boxes (e.g., Cambridge, MA; Columbus, OH; New York, NY; Portland, OR; San Francisco, CA). One of the criticisms

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[3] See www.truckview.net/.

Figure 23. *Cycle path on an independent alignment in Malmö, Sweden.*

Figure 24. *Advance stop lines for onstreet through and left-turn bike lanes in Bern, Switzerland.*

(at least in the United States) of bike boxes is that they are effective only if the bicyclist arrives at the intersection on the red signal phase, and that they may pose safety concerns to inexperienced bicyclists who try to use them when arriving in the middle of the through green phase. Several host countries dealt with this issue by providing a marked waiting space on the far side of the intersection for left-turning bicyclists to make a pedestrian-style left turn. Conflicts may result when bike boxes are used at locations where right turn on red is permitted (most of the foreign host countries did not permit right turn on red). Right turns on red are commonly allowed in the United States and motorists often do not come to a complete stop, only slow down sufficiently to make the turn.

In most countries, right-turn-on-red restrictions for motorists were the norm rather than the exception. That is, right turn

Figure 25. *Convex mirrors improve bicyclist visibility for drivers of large or high-profile vehicles in Bern, Switzerland. (Note: photo taken from vantage point of motorist at stop line.)*

on red for motorists was restricted unless otherwise signed. In the United States, right turn on red is permitted unless otherwise signed.

Bicycle Traffic Signals

Bicycle-specific traffic signals were used in nearly all countries (the exception was the United Kingdom) to control bicycle traffic movements (figure 27, see next page). The bicycle traffic signals were smaller than the motor vehicle signals and were mounted on both cantilever support arms and short poles behind the curb. In most cases, a bicyclist plaque accompanied the signal or a bicycle symbol was integral to the signal lens cover. From the scan team's anecdotal experiences, bicyclist comprehension of and adherence to the bicycle traffic signals appeared to be very good. In most cities, the bicycle traffic was dense enough that visiting or inexperienced bicyclists could simply follow the example of the bicyclists in front of them when trying to navigate a complicated intersection.

Bicycle traffic signals are used to reduce turning conflicts at signalized intersections and often provide separate and sometimes exclusive phases for bicyclists, such as the following:

- Bicyclists may be given an advance green that precedes the motorist green by several seconds.

Figure 26. *Bike boxes provide better visibility for turning bicyclists in London, United Kingdom.*

- Bicyclists may be given an exclusive green phase in which to make left turns.
- Bicyclists may be given a red phase while right-turning motorists have an exclusive turning phase.

Pavement Markings at Intersections and Conflict Areas

Several different types of pavement markings were used at intersections to reduce conflicts or direct attention to areas of potential conflict. The most common pavement marking was the use of color (blue in Denmark, red in Germany and Switzerland) for bike lanes (figure 28). Colored bike lanes have been tested in several U.S. cities (e.g., Burlington, VT; Cambridge, MA; Chicago, IL; Portland, OR; Seattle, WA; St. Petersburg, FL; Tempe, AZ) as a way to guide bicyclists through complex intersections as well as to make turning or passing motorists aware they are crossing a bike lane. In most U.S. applications, the contrasting color pavement has been used for short sections of the bike lane and not as a continuous color treatment along the entire length of the bike lane. A Danish research study[4] (described in Chapter 7) found that the use of one blue bike lane crossing reduces the number of intersection crashes by 10 percent, whereas marking two and four blue bike lane crossings through an intersection increases the number of crashes by 23 percent and 60 percent, respectively. A study of blue bike lanes in Portland, OR, reached the following conclusions:[5]

Figure 27. *Bicycle traffic signals control bicycle traffic movements at signalized intersections in Potsdam, Germany. (Note: A blue plaque placed in the highest signal lens is not intended to control bicycle movements.)*

Figure 28. *Colored bike lane at potential conflict area in Winterthur, Switzerland.*

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[4] Jensen, Søren Underlien. "Safety Effects of Blue Cycle Crossings: A Before-After Study." *Accident Analysis and Prevention,* Vol. 40, 2008, pp. 742-750.

[5] Hunter, W.W., D.L. Harkey, J.R. Stewart, and M.L. Birk. *Evaluation of the Blue Bike Lane Treatment Used in Bicycle/Motor Vehicle Conflict Areas in Portland, Oregon.* FHWA-RD-00-150, Federal Highway Administration, August 2000.

- Significantly more motorists yielded to bicyclists and slowed or stopped before entering the blue pavement area.
- More bicyclists followed the colored bike lane path.
- Fewer bicyclists turned their heads to scan for traffic or used hand signals.

At a few large intersections, onstreet bike lanes were dashed through intersections (with no fill color) to provide guidance to bicyclists (figure 29).

In Germany, longitudinal bike symbols were provided at driveways and stop-controlled cross streets. These bike symbols were oriented to be seen by motorists turning across the bike lane (figure 30).

Another pavement marking used in Germany was a dashed bike lane line (figure 31). A dashed bike lane is also called an "advisory bike lane" or a "suggested bike lane" in other countries, such as the Netherlands. The dashed bike lane is used on narrower, lower volume streets that do not have sufficient width to provide a full-width bike lane and full-width motor vehicle lanes. Motor vehicles may enter the dashed bike lane to pass oncoming motor vehicles, but must share this dashed bike lane with bicyclists.

Signal Timing for Bicyclists

Copenhagen has several heavily used bike routes on which the motor vehicle traffic signals were synchronized to a bicyclist speed of 20 kilometers per hour (km/hr) (12 miles per hour (mi/h)) (figure 32, see next page). As long as a bicyclist maintains this average speed, he or she is very likely to pass through most intersections with a green phase. On the inbound route shown in figure 32, the traffic signals were synchronized in this pattern on Monday through Friday from 6 to 10 a.m. In Danish, this was referred to as "grøn bølge" or "green wave." Bicycle signal timings can also provide an earlier yellow and red indication to accommodate the increased clearance times bicyclists require at intersections.

Low-Speed Street Design

The scan team observed the use of low-speed street designs in both residential and commercial areas that were especially conducive to walking and bicycling. For example, the city of Bristol, England, has implemented 20 mi/h (12 km/h) "home zones" in its new residential development.

[6] A scan team member made a personal visit to Osnabrück, Germany, before the official scan trip.

Figure 29. *Dashed bike lane provides guidance through a wide intersection in Osnabrück, Germany.*[6]

Figure 30. *Bike symbols oriented to motorists turning at a driveway in Berlin, Germany.*

Figure 31. *Dashed bike lane in Potsdam, Germany.*

Figure 32. *"Green wave" cycle track in Copenhagen, Denmark, on which traffic signals are synchronized to bicyclist speeds.*

Several cities in Germany, Sweden, and Switzerland also have implemented low-speed streets (20 to 30 km/h or 12 to 19 mi/h) in both residential (figure 33) and commercial (figure 34) areas. The host countries have different criteria for applying low-speed street design, as well as different levels of traffic control devices on these low-speed streets. Several foreign hosts indicated that certain criteria should be met for these low-speed street designs to operate properly: 1) relative speeds of the different modes should be similar, 2) flows (volumes) of users should be similar, and 3) "see and be seen" is a critical design element that encourages increased communication and interaction between modes.

In Bern, Switzerland, motor vehicle access to a low-speed street in a commercial area was controlled by retractable bollards. Authorized users (such as freight delivery personnel or store owners) swiped an access card across a security pad to retract the bollards and gain access (figure 35).

Figure 33. *Residential street in Bern, Switzerland, with pedestrian priority posted with 20 km/h speed limit.*

Figure 34. *Pedestrian priority zone in commercial area of Winterthur, Switzerland.*

Figure 35. *Retractable bollards provide access to pedestrian streets for authorized users in Bern, Switzerland.*

Outdoor parking next to train station (Lund, Sweden)

Secure indoor parking (Lund, Sweden)

Three-level secure indoor parking (Bern, Switzerland)

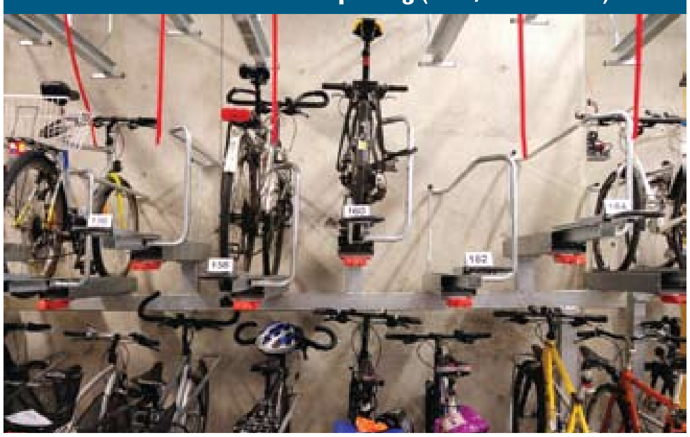


Figure 36. *A variety of bike parking is provided at transit stations.*

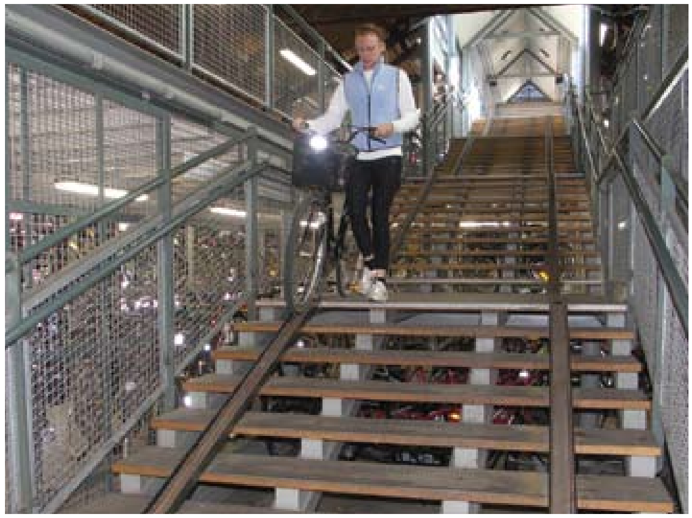


Figure 37. *Bike-friendly steps in a multilevel transit station in Lund, Sweden.*

Integration of Biking and Walking With Public Transit

The scan team observed close integration of bicycling and walking considerations with public transit (including intercity rail) that makes longer intermodal commutes by bike practical as well as safer and more convenient. These considerations include the following:

- A variety of bike parking solutions at stations, including plentiful and convenient bike racks, covered outdoor parking, and secure indoor parking (figure 36)
- Policies that permit bikes on trains and buses, even during peak times
- Low-cost or free short-term bike rental or sharing programs located in or near train or bus stations, with involvement in or ownership by the transit agency
- Channels or ramps on stairways that make it easier to use steps while pushing a bike (figure 37)
- Public taxis with quick-mount bike racks for passengers

CHAPTER 4

Education Elements

In the context of this report, education means informing road users about traffic regulations and safe and appropriate behavior. Many of the education programs discussed during the scanning study were for pedestrians and bicyclists, but motorist education was also mentioned.

Traffic Safety Education for Children

Many of the foreign hosts had extensive traffic safety education programs for children. The programs involve participation from a wide variety of organizations. The most-often-mentioned program was a Children's Traffic Club that provided ongoing, age-appropriate safety material to parents and children, as well as fun learning activities.

Figure 38. *Children's Traffic Club Web site in the United Kingdom.*

SOURCE: WWW.TRAFFICCLUB.CO.UK

For example, the Danish Road Safety Council operates a Children's Traffic Club in Denmark.[7] When they reach age 3, all Danish children receive an offer of membership to the club. About 30 percent of parents register their children for membership. Club members receive a traffic package including a training booklet and toys every 6 months until they reach age 6½. The club has existed for more than 30 years. Also, since 1994, road safety education has been mandatory in Denmark's lower and secondary primary (elementary and middle) schools. Local discretion is used to determine how and when classes should take place.

The United Kingdom has a similar Children's Traffic Club[8] modeled after successful programs in Norway and Sweden. The United Kingdom Children's Traffic Club (figure 38) is designed to teach 3- and 4-year old children about road safety. In the United Kingdom, the voluntary program is offered by local road safety or public health authorities who wish to make the safety education material available in their area. The materials are offered free to parents or caregivers, and the typical participation rate is 60 percent in areas where it is offered. When children become members of the club, they receive a series of six books through the mail (one about every 3 months), as well as stickers, information about competitions, and a membership certificate. Additional safety education materials for home and group settings are also available through the United Kingdom Children's Traffic Club.

As part of Bristol's Cycling City national demonstration, officials plan to offer the Bikeability bicycle safety program.[9] Bikeability is a government-approved, nationally recognized bicycle safety training and education program that has been standardized and is maintained by the United Kingdom's Cycle Training Safety Board. The Bikeability program is voluntary and consists of three levels:

- **Level 1**—For children up to age 9, it teaches basic skills in a playground environment.
- **Level 2**—For children aged 9 to 11, it teaches intermediate skills on low-volume streets.
- **Level 3**—For children older than 11 and adults, it teaches advanced skills on all road types.

Also part of the Cycling City national demonstration, the city of Bristol offers the Bike It program to local schools. The Bike It program, developed by Sustrans (the United Kingdom's leading sustainable transport charity) to educate and promote biking to school,[10] is offered at numerous locations in the United Kingdom. The goal of Bike It is to create a procycling culture in schools that continues long after the Bike It officers have finished their work. The Bike It program is

[7] See www.sikkertrafik.dk/10a20029.
[8] See www.trafficclub.co.uk/.
[9] See www.bikeability.org.uk.
[10] See www.sustrans.org.uk/what-we-do/bike-it.

SOURCE: GOOGLE MAPS, HTTP://MAPS.GOOGLE.COM

Figure 39. *Aerial view of reduced-scale closed course for traffic safety education for children in Winterthur, Switzerland.*

SOURCE: PRESENTATION BY STEFAN GERBER, CITY OF WINTERTHUR, SWITZERLAND

Figure 40. *Closed-course traffic safety education for children in Winterthur, Switzerland.*

intended to work directly with schools by helping schools make the case for cycling in school travel plans, supporting cycling champions in schools, and demonstrating that cycling is a popular choice among children and parents. The city of Winterthur, Switzerland, uses a "traffic garden" (a landscaped, reduced-scale closed course that includes traffic signals, roundabouts, bike lanes at intersections, sidewalks, work zones, public benches, and other common traffic situations) to teach elementary school-age children to ride bikes safely in traffic (figures 39 and 40). In operation since 1978, the traffic training area is run by the city police department with plantings maintained by a local garden club.

Transport for London has developed several road safety education campaigns specifically targeted to teenagers:

- Don't die before you've lived.
- Don't let your friendship die on the road.
- Look after your mates.

The campaigns are distributed though television and print media (posters, billboards, etc.) and typically feature a provocative, attention-grabbing image (figure 41). Transport for London staff use a fairly elaborate process for developing safety education campaigns (which are all components of the branded THINK! traffic safety campaign). They typically have a target road user group (e.g., teenagers, truck drivers, bicyclists, etc.) for each campaign that is based on recent crash statistics and trends. Private marketing companies are involved in the creative development, while Transport for London marketing staff ensures that the creative story fits with the overall road safety theme. After the campaign material has been released, Transport for London conducts followup studies to test target audience message recognition and understanding. In some cases, future releases of the same campaign may be refined to be more effective within certain demographic groups.

Traffic Safety Education for Adults

The scan team observed higher levels of bicycle helmet use than expected in the countries visited. Helmets were uniformly encouraged for children and adults. Most countries emphasized physical activity first and helmets second. Their rationale was that required helmet use discourages bicycling (physical activity), which could have a greater public health detriment than head injuries resulting from crashes. Bicycle helmet use was recognized not as a crash-prevention measure, but as the most effective countermeasure for preventing head injury from a crash.

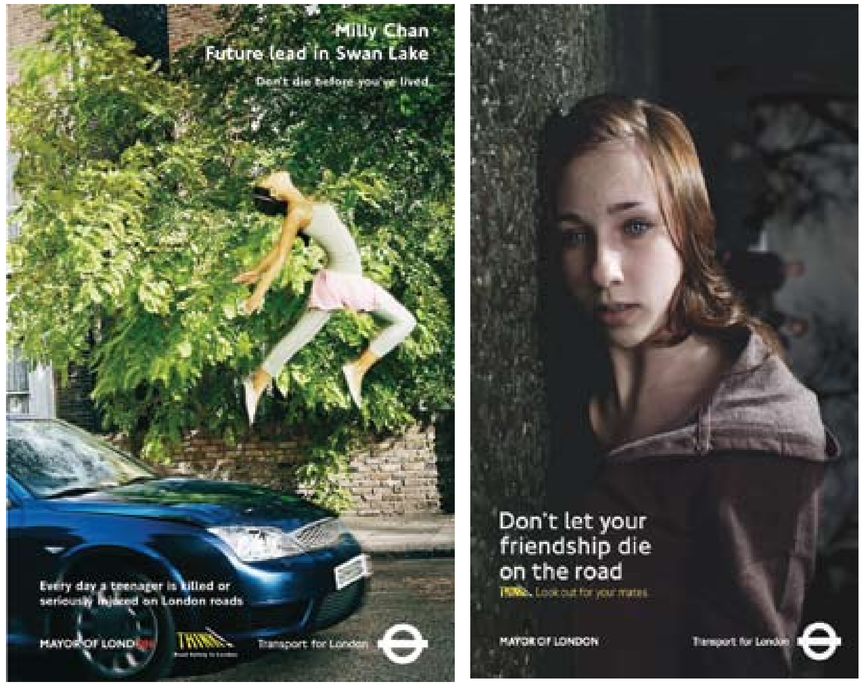
Copenhagen and the neighboring city of Frederiksberg cooperate on traffic safety education campaigns (in Danish, Byens Trafikråd).[11] In the past few years, these campaigns have included the following:

[11] See www.byenstrafikraad.dk/.

- Providing free reflective vests and reflectors for children and adults
- City police providing free bicycle headlights to bicyclists without headlights
- Providing free bicycle helmets
- Educating bicyclists about blind spots when trucks turn right
- Educating bicyclists about riding in the "door zone" next to parked cars

Motorist Education and Awareness Programs

The United Kingdom appeared to have the most extensive motorist education and awareness programs among all the countries visited during the scanning study. The United Kingdom's Department for Transport has a single unifying brand called THINK! for its road safety education program.[12] The THINK! brand incorporates numerous focus areas targeted to improve safety for various road user groups, such as cyclists, pedestrians, children, teenage drivers, and motorcyclists. The most recent national pedestrian campaign, called Tales of the Road,[13] includes an interactive Web site for children and other media (television, cinema, and online advertising).



SOURCE: PRESENTATION BY NICK BAKER, TRANSPORT FOR LONDON

Figure 41. *Transport for London's pedestrian road safety campaign for teenagers.*

Transport for London has released several motorist awareness videos under the THINK! brand.[14] The first campaign showed a moonwalking bear in the midst of two four-person teams passing basketballs, with instructions to count the number of passes a particular team made. Most viewers were so intent on counting the number of basketball passes that they did not see the bear,[15] a phenomenon called attention blindness. The campaign tagline is "It's easy to miss something you're not looking for: Look out for cyclists." Subsequent videos from Transport for London have been modeled after the British genre of "Whodunit" murder mysteries.

Key Findings

Key findings related to education are as follows:

- **Many of the foreign hosts have pervasive and widespread traffic safety education programs for all children.** The education programs start at an early age and some continue through the teenage years. These traffic safety programs involve participation from a wide variety of organizations, including schools, businesses, civic organizations, police, public health groups, and parks and recreation departments. For example, several countries had a Children's Traffic Club program that provided ongoing, age-appropriate safety material to parents and children, as well as fun learning activities. Also, most pedestrian and bicyclist safety education programs were integrated into the overall traffic safety program.

- **The use of a single brand appeared to be effective at connecting various traffic safety education efforts.** For example, the United Kingdom's THINK! brand has several focus areas with a common theme. U.K. officials believe that the single brand helps the public identify all traffic safety issues (including pedestrian and bicyclist safety) as related and important.

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12 See www.dft.gov.uk/think/.

13 See talesoftheroad.direct.gov.uk.

14 See www.dothetest.co.uk/.

15 See www.youtube.com/watch?v=47LCLoidJh4.

CHAPTER 5

Enforcement Elements

In the context of this report, enforcement means compelling all road users (motorists, motorcyclists, bicyclists, and pedestrians) to obey traffic regulations. Enforcement actions are most often a monetary fine and, in some cases, restriction of certain privileges (such as driving).

Figure 42. *Photo enforcement at a traffic signal in Bern, Switzerland.*

The host countries seldom mentioned enforcement when discussing strategies to improve pedestrian and bicyclist safety. The specific reasons for this are unknown. Followup questions to the hosts often indicated their preference for nonpunitive strategies. For example, educational strategies such as improved driver training or child bicycling education were sometimes mentioned. In Winterthur, Switzerland, the city police department is actively engaged in childhood education for pedestrian, cycling, and general behavior on the road (depending on age group) (see Chapter 4), which provides legitimacy to this activity. In Switzerland, municipalities are required by law to educate children about traffic behavior. In Winterthur, the city council has appointed the city police department to perform this task. In other cases, the hosts indicated that they strive to design self-enforcing roads (i.e., good design invites right use) so that motorist speeding is difficult or uncomfortable.

When enforcement was discussed, it was related mostly to motorist actions, such as speeding, running red lights, or not yielding at pedestrian crossings. Anecdotal observations by the scan team did indicate that photo enforcement of traffic signals and speed limits was common in most countries (figure 42). In London, several bus lanes and congestion charging zones were enforced using stationary camera systems. Buses in London have front-facing cameras that can be used to photograph and issue tickets to motorists who drive or park in bus lanes. In Sweden, there has been some discussion on using intelligent speed adaption (automatically limiting vehicle speeds based on the road) for local governments' fleet vehicles.

Enforcement actions for pedestrians and bicyclists were mentioned less often than for motorists, and most related to bicyclists not observing traffic signals or stop signs. Anecdotal observations in most host cities indicated high levels of pedestrian and bicyclist compliance with traffic signals and other traffic control devices. In fact, several scan team members frequently commented on how orderly the traffic was compared to the typical U.S. experience. For example, pedestrians typically crossed with pedestrian signals at intersections, bicyclists obeyed traffic signals even when no crossing traffic was present, and motorists were courteous and attentive at intersections and other pedestrian crossings. The scan team did not see motorists encroaching on bike boxes or pedestrian crosswalks, or bicyclists encroaching on pedestrian crosswalks. The team observed that mobile phone and texting device use by motorists did not appear to be as common as it is in the United States. Motorists making right turns across bike lanes or cycle tracks used their turn signals and yielded to numerous through bicyclists before turning right.

Key Findings

Key findings related to enforcement are as follows:

- **The scan team observed the widespread use of photo enforcement for traffic signals and speed limits.** Although photo enforcement is viewed primarily as a tool for improving motor vehicle safety, better motorist compliance with speed limits and traffic signals also improves pedestrian and bicyclist safety.

CHAPTER 6

Encouragement

In the context of this chapter, encouragement means promoting walking and cycling as a travel mode. Promotion of walking and cycling can take many forms. For example, it could include marketing the benefits, providing additional information, providing complimentary services, or providing incentives and certain facilities for pedestrians and bicyclists. In many cases, encouragement and promotional activities are viewed as the small details that can make a big difference in travel mode choice. Many of these small details can make walking and cycling easy and convenient.

This chapter presents examples of encouragement and promotion of walking and cycling identified during the scanning study. The examples have been selected to present unique or different ideas from those activities not already commonly undertaken in the United States.

Route and Wayfinding Signs

Route and wayfinding signs were common in the cities visited during the scanning study. Several countries have national standards for bicycle route signing. For example, Switzerland has signing standards that include onroad and offroad biking, hiking, and inline skating (figure 43, left side). Germany also has national route signing standards, and the bicycle route signs the scan team observed included the distance to the destination (figure 43, right side).

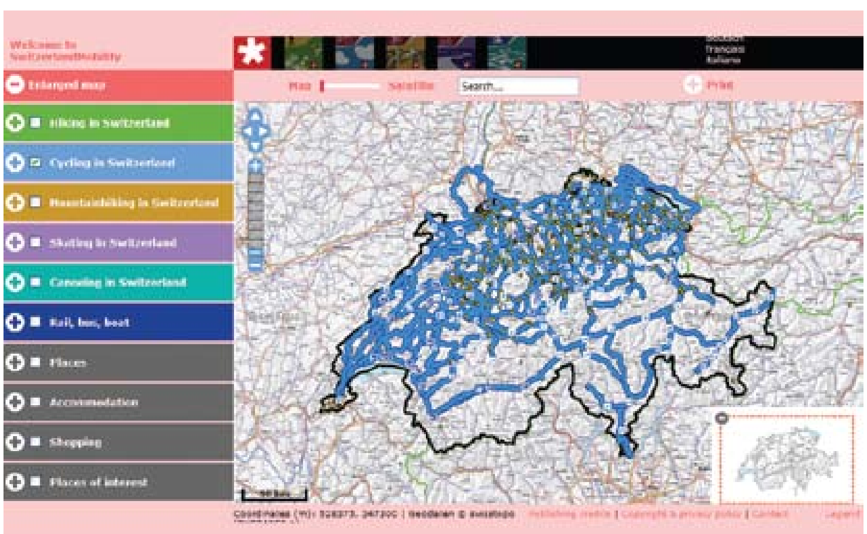
Route and Destination Planning

The Switzerland Mobility Foundation has partnered with transportation, tourism, and sport agencies to create a map-based route and destination planning tool on the Internet called SwitzerlandMobility (www.switzerlandmobility.ch). The map tool (figure 44) includes hiking, cycling, mountain biking, skating, canoeing, and rail, bus, and boat routes. The Swiss Federal Roads Office provides support to this activity, as do several other federal departments and regional and local municipalities. Several foreign hosts commented on the economic value of walking and biking, particularly for recreation and tourism.

Marketing Campaigns

Several host cities actively market and promote walking and bicycling as alternatives to driving. In Malmö, Sweden, the city promoted the use of bikes to replace short car trips (3 to 5 km, or 2 to 3 mi). The campaign title was "Hälften av alla bilresor som görs i Malmö är löjligt korta," or "Half of all car

Figure 43. *Route signs in Switzerland (left) and Germany (right).*



SOURCE:WWW.SWITZERLANDMOBILITY.CH

Figure 44. *National route and destination planning tool showing cycling routes in Switzerland.*

Figure 45. *Incentives to reduce short car trips in Malmö, Sweden.*

Figure 46. *Updated promotional banners to reduce "ridiculously short" car trips in Malmö, Sweden.*

trips in Malmö are ridiculously short." The campaign included several elements:

- General information through advertisements, brochures (e.g., "You won't be ridiculous, will you?"), bike maps, and other giveaways
- Actual cyclists doing stationary pedaling in front of billboards
- Highly visible cyclists (wearing fluorescent-orange vests and silver helmets) looping through rush-hour traffic giving out information to motorists stopped for traffic signals
- A placard on fleet bicycles used by municipal staff during work hours
- An annual "confession" contest in which participants submit their most "ridiculously short" car trips (figure 45)

The "ridiculous car trips" campaign is considered effective, and Malmö plans to repeat the campaign once a year. Surveys from the initial campaign (May 2007) indicated that 50 percent of city residents recognized the events and 9 percent of survey respondents now use their cars less frequently. When the scan team visited Malmö in May 2009 (2 years after the initial campaign), the city had updated its marketing material from "Half of all car trips . . ." to "38 percent of all car trips . . ." (figure 46), a visible indication that the city was making progress in shifting short trips away from cars.

To complement this "ridiculous car trips" campaign, Malmö has initiated a Friendly Way to School program (similar to Safe Routes to School). Before the campaign, about 80 percent of parents drove their children to elementary school, even though 78 percent live within 1 km (0.6 mi) of the school. After the campaign, the share of students being driven dropped to about 50 percent.

Various groups in Copenhagen are actively marketing and promoting cycling as a sustainable means of transport

SOURCE: PRESENTATION BY STEFFEN RASMUSSEN, CITY OF COPENHAGEN, DENMARK

Figure 47. *Marketing material for cycling in Copenhagen, Denmark.*

Figure 48. *City fleet bicycles in Malmö, Sweden.*

and a lifestyle choice (figure 47). In a 2015 visioning document,[16] one of four major themes is for Copenhagen to be the "world's best city for cycles." The Copenhagen tourism and visitor's bureau markets cycling, featuring it prominently on the front page of its Web site at www.visitcopenhagen.com.

[16] *Eco-Metropole: Our Vision for Copenhagen 2015.* Municipality of Copenhagen, ISBN 978-87-7072-000-7, 2007.

Shared and Rental Bike Programs

Shared and rental bike programs also were common in many of the host countries. For example, Malmö, Sweden, recently purchased a fleet of bikes for use by city employees during working hours (figure 48). Each bicycle features a placard about the city's "ridiculously short trips" campaign. In addition to secure bike parking, the VeloStation in Bern, Switzerland's, main train station also provides free bike rentals for up to 4 hours. VeloStation bikes may be used longer than 4 hours for

Figure 49. *Rental bike in Berlin, Germany.*

Figure 50. *Free public-use "city bikes" in Copenhagen, Denmark.*

a nominal rental fee. In Germany, the national railway company Deutsche Bahn (DB) provides rental bikes (figure 49) in inner-city areas of Berlin, Cologne, Frankfurt, Karlsruhe, Munich, and Stuttgart. For the German DB rental bikes, users can register in advance on the Internet or on the spot using a cell phone. In several German cities, the first 30 minutes of bicycle use is free.

Free Public-Use Bikes (City Bikes)

The city of Copenhagen has distributed about 2,000 free public-use bikes (also called "city bikes") at 100 designated bike racks throughout the inner-city area (figure 50). A small deposit (a Danish 20-kroner coin, about US$4) is required to unlock the Copenhagen city bike, and the deposit is returned once the bike is locked to a designated rack. A central repair shop and four mobile repair units keep the city bikes in working order. A tourist map of city sights is permanently affixed to the bike handlebars because the Copenhagen city bikes are popular among tourists. The city bike program is sponsored largely by advertising revenue.

Free Hotel Guest Use Bikes

Several hotels the scan team stayed at featured free bicycles for guest use stationed at the entry door (e.g., Copenhagen, Bern). This trend is common across Europe as hotels compete on amenities related to sustainability and energy conservation.[17] Increasingly, the dilemma is that guests' bicycle demand outstrips availability. Many hotels also provide bicycle parking for guests who bring their own bicycles.

[17] See "Europe on Two Borrowed Wheels," *New York Times*, May 3, 2009, page 6.

Utility Bicycle Designs

Bicycles appeared in all shapes and sizes in the cities the scan team visited, making it possible for people to bicycle in normal clothing and conveniently carry children, cargo, and more (see figure 51). Moreover, bicycles typically included kickstands, making bicycle parking possible virtually anywhere, and easy-to-use onboard wheel locks to deter theft. The range of bicycle types appeared to be in keeping with the range of transportation options available in the cities visited, some of which were predominantly for tourist use. Very young children were seen practicing their balancing and bike-riding skills on training bicycles without pedals.

Bicycle Service Facilities

Several cities provided air pumps for tires at locations with high levels of bike traffic. Along one of its bicycle demonstration routes, the city of Malmö, Sweden, installed an air pump and several bike tools secured to a pole (figure 52, see page 42). This location also featured a large route map, making it a convenient one-stop opportunity for cyclists.

Bicycle Parking

Bicycle parking facilities were more prevalent in the cities the scan team visited than in most U.S. cities. The city of Winterthur, Switzerland, provided two-level bicycle parking near an open-air public market to encourage residents and visitors to bicycle there. Bicycles sold in Europe tend to be more suitable for daily transportation use, offering kickstands to make it easy to park almost anywhere and onboard wheel locks to deter theft without necessitating permanent bicycle parking facilities. Government officials provided several types of covered bicycle parking outside the city office building in Malmö, Sweden. In Berlin, city officials installed bicycle racks

Figure 51. *Multifunctional bicycles were seen in all shapes and sizes.*

in what had been car parking spaces in front of the federal government building. Officials in Potsdam, Germany, provided covered parking outside the train station. (See Chapter 3 for information on bicycle parking at train stations.) A benefit of dedicating more space for public use (such as providing wider sidewalks in front of stores and public buildings or creating public plazas) is the opportunity to provide abundant, convenient bicycle parking.

Bike Barometers

Bike barometers are automatic counters that display a subtotal of daily and year-to-date bicyclists passing a certain point (figure 53, see page 42). Several host cities placed automatic counters in highly visible areas to demonstrate the current level of bicycling and promote additional use. In several cases, an air pump for bike tires was also provided next to the automatic bike counter. These bike barometers were a point of pride for city staff and residents and a reminder that what gets counted counts.

Public Spaces and Pedestrian Service Facilities

A consideration relevant to a culture of encouragement is the prevalence of public gathering places, sidewalk cafes, and public toilets. It was not unusual to see crowds of people of all ages enjoying sunshine and others' company on park benches, along waterways, and under café umbrellas. There are destinations for people to walk and bicycle to, their needs are met once they arrive, and they are not rushed to do their business and move on. A less hurried pace allows people to enjoy the vibrant use of public spaces.

Key Findings

The key findings on encouragement and promotion of walking and cycling are as follows:

- **Many of the foreign hosts use promotional programs and activities to encourage and enable more walking and biking.** These encouragement

Figure 52. *Bicycle tire air pump (top, "luft" is Swedish for "air") and tools (bottom) provided at popular bicyclist locations in Malmö, Sweden.*

Figure 53. *Bike counter (daily and year-to-date subtotals) and air pump in Copenhagen, Denmark.*

activities are considered a tool to meet mode share goals as well as increase pedestrian and bicyclist safety. Many foreign hosts viewed higher levels of walking and biking as a way to improve safety (the "safety in numbers" effect). Where walking and bicycling are considered the norm, a certain amount of encouragement happens inherently, by example. Common examples of promotional programs and activities include the following:

- Well-marked routes with wayfinding signs and printed maps
- Web-based biking and walking route planning and maps, including extensive countryside pathways inviting tourists and other occasional users
- Well-maintained shared-bike programs for public agencies, private companies, or the general public
- Free or very low cost public-use bicycles that the city or transit agency maintains in good working order
- Routine provision of quality bike racks at convenient locations, made possible in part because of the prevalence of public space
- Employer-sponsored programs (bike-to-work incentives)
- Marketing campaigns to reduce or shift short car trips
- Wellness and physical activity programs jointly sponsored by public health and transportation agencies
- Personalized travel planning (like the Portland, OR, -based Smart Trips program, www.walkinginfo.org/library/details.cfm?id=3961)

Several cities provided a showcase counter in a highly visible location to demonstrate daily and annual bicycle use. Although this tool was noted to yield varying and, in some cases, inaccurate results, it was a point of pride and a reminder that what gets counted counts.

CHAPTER 7

Evaluation

In the context of this chapter, evaluation is the act of examining results to ensure that goals are met. Evaluation can be part of a regular monitoring process that measures progress toward goals such as biking and walking mode share or safety. For example, many of the host countries conducted pedestrian and bicyclist counts or travel surveys to determine how biking and walking levels are changing as programs are implemented. Evaluation can also take the form of focused studies on innovative practices, designs, or programs. Many host countries (and even the United States) routinely evaluate new or innovative intersection designs and traffic control devices. This chapter includes several examples of evaluation approaches the scan team identified during the scanning study.

Berlin, Germany

Several of the foreign hosts have increased their monitoring of walking and cycling levels in recent years, and have also backcasted historical estimates based on travel surveys and other available data. For example, Berlin has estimates of bicycle use since 1951, even though its first year-round bicycle traffic count was performed in 2001 (figure 54). This technique takes advantage of newer data collection activities and helps put recent limited-count data into the proper historical perspective.

Copenhagen, Denmark

The city of Copenhagen has published a *Bicycle Account* every 2 years since 1995 that provides "an assessment of the city's record when it comes to cycling." The most recent edition is the 2006 *Bicycle Account,*[18] which contains information on these areas:

- Cyclists' satisfaction ratings on perceived safety, facilities, and other categories

[18]Available at www.vejpark2.kk.dk/publikationer/pdf/464_Cykelregnskab_UK.%202006.pdf.

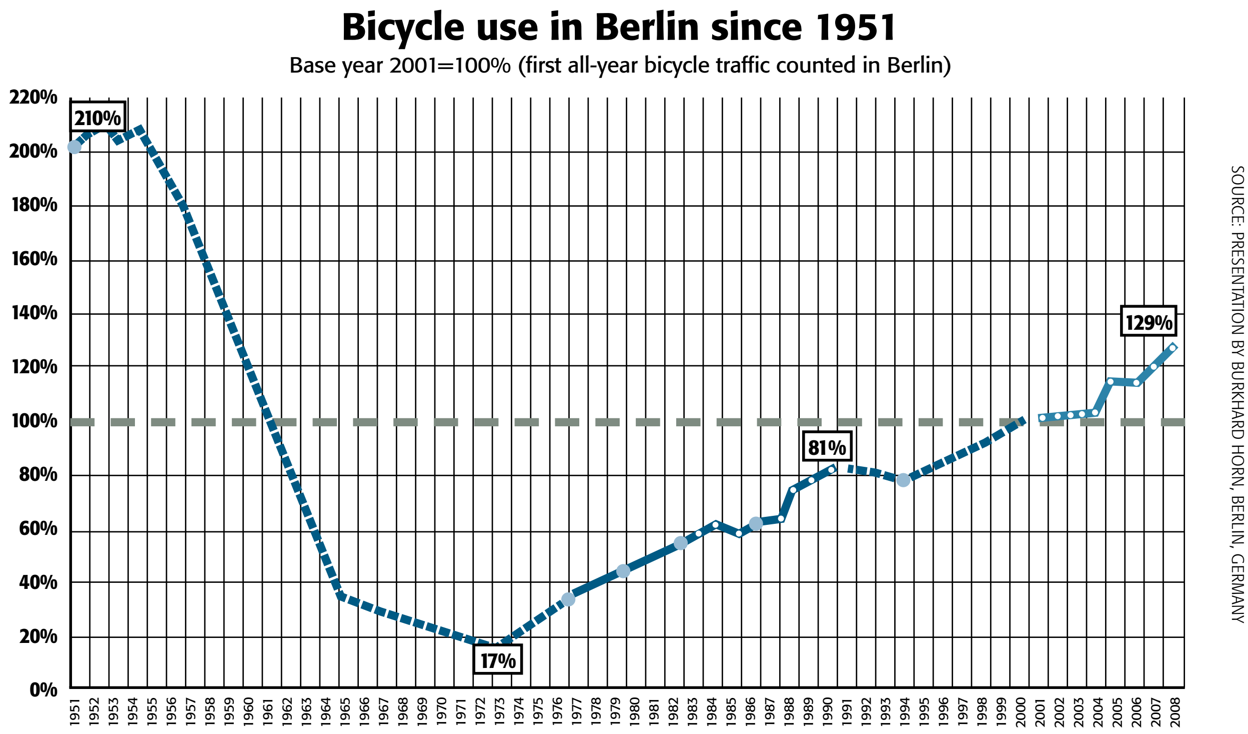


Figure 54. *Bicycling trends in Berlin, 1951–2008.*
(Note: Line that starts in 2001 indicates start of all-year bicycle traffic counts.)

- Key figures (total kilometers cycled, total facility extent, parking spaces, etc.)
- Cycle policy targets:
  - Proportion who cycle to work (percent)
  - Cyclist risk (serious casualty per million km cycled)
  - Cyclist sense of safety (percent)
  - Cyclist travel speed (km/h)
  - Cycling comfort (unsatisfactory surface in percent)

The *Bicycle Account* also includes information about funding levels, new initiatives, public health benefits, and brief results from recent safety evaluations. This biennial report is brief, has a professional layout with colorful pictures, and appears to be oriented to nontechnical audiences. Samples of key statistics are shown in figure 55.

London, United Kingdom

Transport for London, the regional transport authority for London, has been monitoring pedestrian and bicyclist levels for several years, using both manual and automated counting systems. Manual bicycle counts have been performed at numerous locations at varying frequencies since 1972. Since 2001, central cordon bicycle counts have been performed every year. Bike counts across several Thames River bridges are now performed four times per year (figure 56, top). Bicycle counts on parts of the network are estimated from motor vehicle counts. Transport for London also has 96 locations at which bicyclist counts are from automatic counters (figure 56, bottom).

Fewer locations are routinely counted for pedestrians. Several Thames River bridges are manually counted on a quarterly basis, and one-time pedestrian counts are conducted for special studies. Transport for London recently installed automatic counters for pedestrians at 54 sites, but experience with these automatic pedestrian counters has been limited to date.

The pedestrian and bicyclist counts are used in a variety of agency applications, including network planning, safety analyses, performance reporting, and public service announcements.

Overview 1995 - 2006

Key figures and Cycle Policy target figures were calculated by the Technical and Environmental Administration with the exception of casualty information (the Police) and the proportion who cycle to work (Danish Transport Research Institute).

	2006	2004	2002	2000	1998	1996	1995
Key figures							
Kilometers cycled (million km per day)	1.15	1.13	1.11	1.05	0.92	0.93	0.80
Cycle track length (km)	332	329	323	307	302	294	293
Cycle lane length (km)	17	14	12	10	6	-	-
Green cycle route length (km)	39	37	32	31	30	29	29
Cycle track maintenance (DKK million)	7.3	9.9	6.8	9.1	5.3	4.7	3.9
Killed and seriously injured cyclists (number)	92	124	152	146	173	252	231
Serious cyclist casualties at signalized junctions (number)	33	38	52	57	54	88	81
On-road cycle parking spaces (1,000 spaces)	29.5	20.5	-	-	-	-	-
Cycle Policy target figures							
Proportion who cycle to work (%)	36	36	32	34	30	30	31
Cyclist risk (serious casualty per million km cycled)	0.22	0.30	0.38	0.38	0.52	0.74	0.79
Cyclist sense of safety (%)	53	58	56	57	58	60	51
Cyclist travelling speed (km/h)	16.0	15.3	-	-	-	-	-
Cycling comfort (unsatisfactory surface in %)	7	2	5	10	-	-	-

SOURCE: PRESENTATION BY LEE ABBOTT, TRANSPORT FOR LONDON

Figure 55. *Key statistics from Copenhagen's 2006 Bicycle Account.*

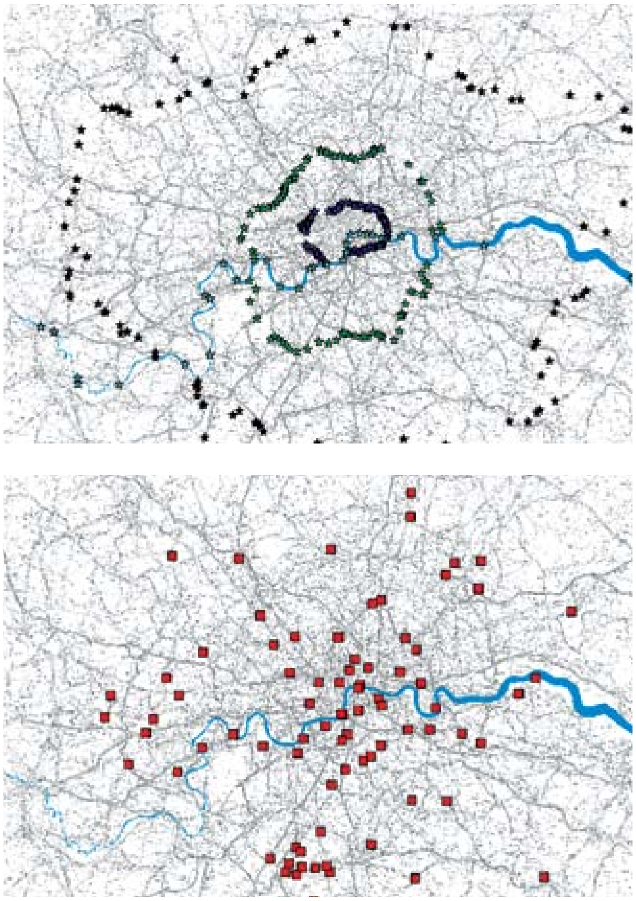


Figure 56. *Manual (top) and automatic (bottom) bicyclist counts in London.*

Lund, Sweden

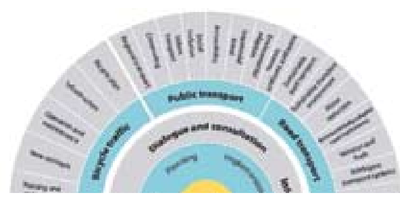
The city of Lund, Sweden, has developed a sustainable long-range transportation plan for 2030 called LundaMaTs. The plan addresses all modes of transport and sets 2013 and 2030 targets for specific areas of the plan. For example, the walking and cycling goals include facility extent, walking and cycling levels, accessibility, perception of safety, and measured safety (figure 57).

Lund also tracks walking and cycling levels and safety on an annual basis. For example, figure 58 (see next page) shows bicycle (first series), car (second series), and public transport (third series) usage levels per capita from 2000 through 2007. Similarly, figure 59 (see next page) shows bicyclist-involved crash index trends from 1996 through 2008. The crash index is a weighted combination of fatal and injury crashes, which is then normalized by the amount of bicycle travel (bicycle-kilometers of travel per year).

Charts and statistics like these were used by several of the foreign hosts to convey basic trend information, justify expended funds, or lobby for additional funding.

LUND

LundaMaTs



Target	Target 2013	Target 2030
The length of walkways and cycleways will increase 10% by 2013 and 30% by 2030.	+10%	+30%
The proportion of safe crossings for pedestrians and cyclists will be 30% by 2013 and 100% by 2030.	+30%	+100%
Walking trips per resident will increase.	Increase	Increase
Cycling trips per resident will increase 5% by 2013 and 10% by 2030.	+5%	+10%
Accessibility for the disabled, children and elderly will increase.	Increase	Increase
The proportion of people who perceive the transport environment as unsafe will decrease.	Decrease	Decrease
The number of people killed or seriously injured in the traffic environment will decrease 25% by 2013 and 50% by 2030 (covers both municipal and national road networks).	-25%	-50%

SOURCE: PRESENTATION BY ANNA KARLSSON, CITY OF LUND, SWEDEN

Figure 57. *Short- and long-range walking and cycling targets in Lund, Sweden.*

SOURCE: PRESENTATION BY ANNA KARLSSON, CITY OF LUND, SWEDEN

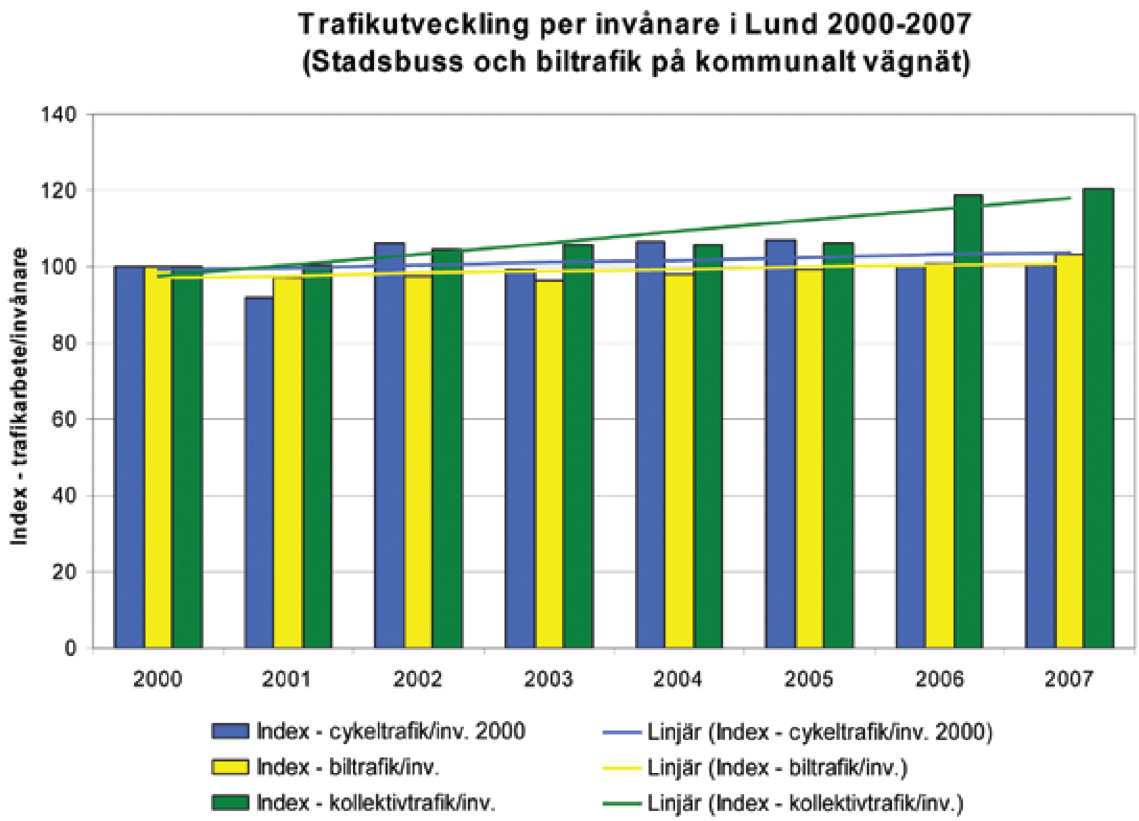


Figure 58. *Bicycle, car, and public transport usage trends in Lund, Sweden.*

SOURCE: PRESENTATION BY ANNA KARLSSON, CITY OF LUND, SWEDEN

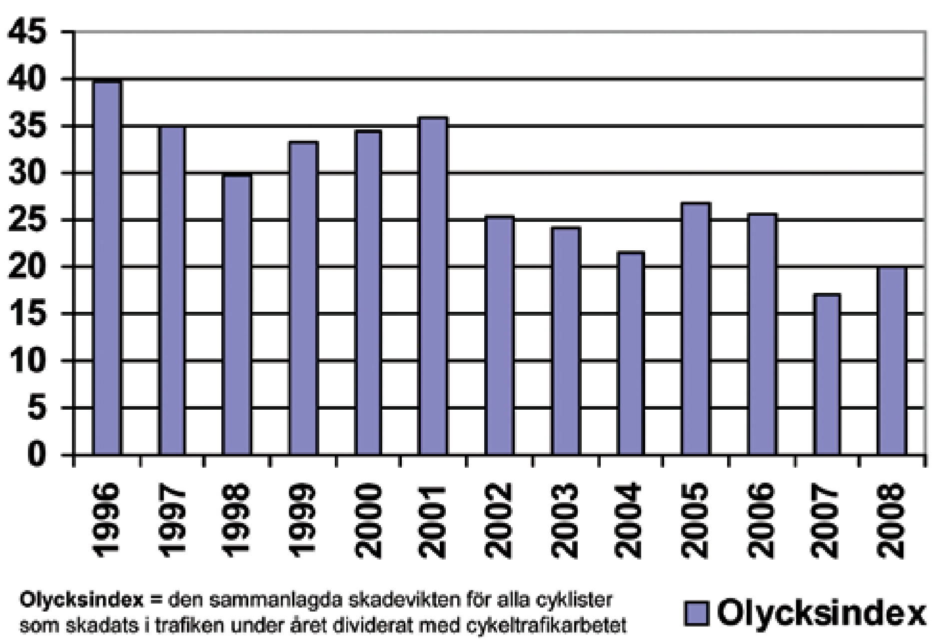


Figure 59. *Bicyclist-involved crash index trends in Lund, Sweden.*

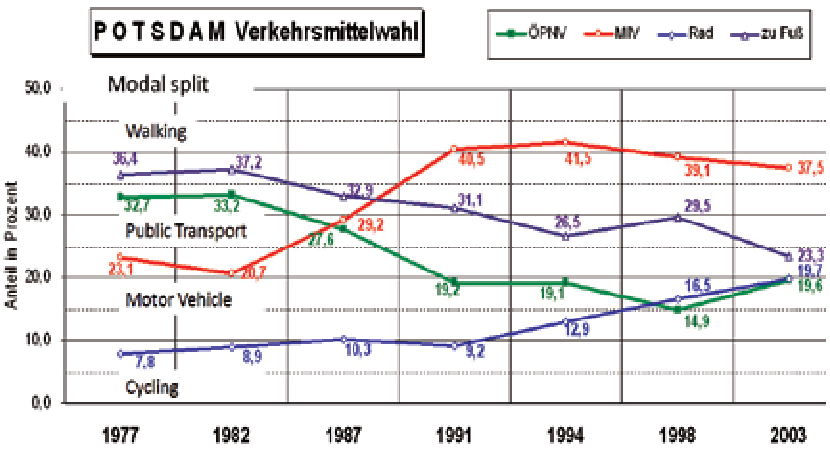


Figure 60. *Modal share trends in Potsdam, Germany, 1977–2003.*

SOURCE: PRESENTATION BY AXEL DÖRRIE, CITY OF POTSDAM, GERMANY

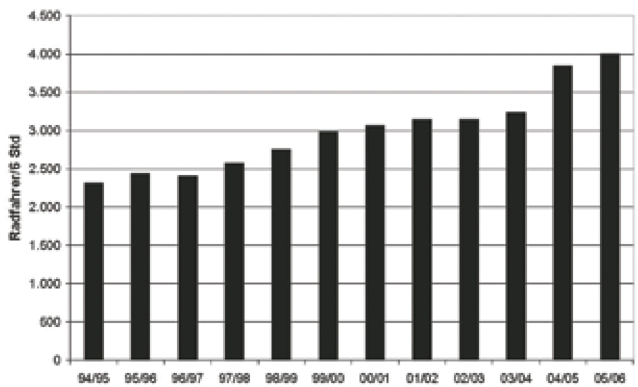


Figure 61. *Six-hour bicyclist counts on a major bridge in Potsdam, Germany, 1994–2006.*

Potsdam, Germany

In some host cities, a systematic citywide process for counting walking and cycling levels was not in place, but available data are used. For example, the city of Potsdam reports a citywide mode share statistic from a household travel survey (figure 60), but has also tracked bicycle counts at a few key locations. Figure 61 shows 6-hour bicyclist counts over a main bridge (Lange Brücke) into the Potsdam city center from 1994 through 2006.

Safety Evaluation Research

In addition to the regular monitoring of walking and cycling levels and crashes, many host countries also conduct safety evaluation research on innovative designs, practices, and traffic control devices. A few of the most relevant evaluation studies are summarized in this section. Additional information on safety evaluation research is available in several FHWA reports.[19]

Swedish researchers have studied the relative pedestrian risk at pedestrian crossings and discovered that, after adjusting for exposure, the crash rates at marked crosswalks were about twice as high as the crash rates at unmarked crossings (figure 62, see next page).[20] This research finding generally corresponds with the FHWA study of marked and unmarked crosswalks.[21] The recommendation from this study was also similar to the FHWA study recommendations: Additional countermeasures are needed to improve the safety of marked crosswalks on wider roads with higher traffic speeds. After further studies in the past two decades, Swedish research has concluded that a raised crossing (with specific vertical differentials) is most effective at improving safety at unsignalized marked crosswalks.

At the request of the municipality of Copenhagen, Trafitec (a Danish consulting firm) conducted a comprehensive study to examine the effects that bicycle facilities in Copenhagen have on road safety, traffic volumes, and perceived risk.[22] The study found that the installation of cycle tracks resulted in an 18 to 20 percent increase in bicyclist traffic, but a 9 to 10 percent increase in bike-related crashes. The installation of bike lanes resulted in a 5 to 7 percent increase in bicyclist traffic, but a 5 to 15 percent increase in bike-related crashes. The number of sites included in the study appears to be limited,

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[19] In particular, see *A Review of Pedestrian Safety Research in the United States and Abroad* at www.tfhrc.gov/safety/pedbike/pubs/03042/index.htm.

[20] Ekman, Lars. *Fotgängares Risker På Markerat Övergångsställe Jämfört Med Andra Korsningspunkter.* Bulletin 76, University of Lund, 1988.

[21] Zegeer et al. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines.* FHWA–HRT–04–100, Federal Highway Administration, August 2005.

[22] Jensen, Søren Underlien and Rosenkilde, Claus, and Jensen, Niels. *Road safety and perceived risk of cycle facilities in Copenhagen.* 9 pages, no date.

SOURCE: PRESENTATION BY LARS EKMAN, RAMBOLL

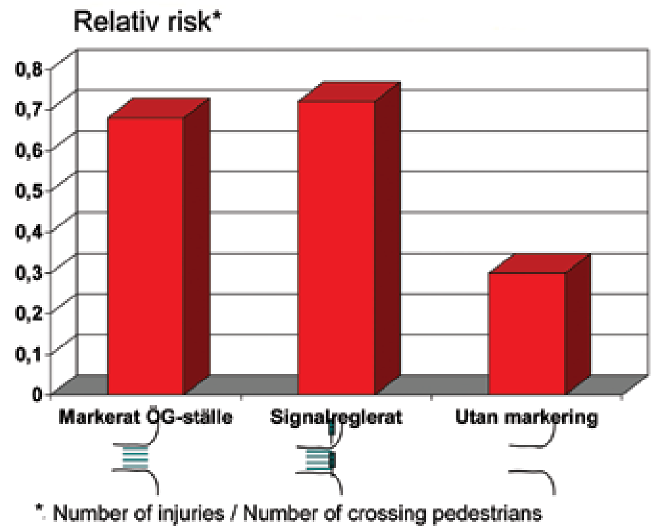

Figure 62. *Swedish research on relative risk at marked, signalized, and unmarked pedestrian crossings.*

and it also appears that the crash analysis did not normalize for cyclist exposure. The full evaluation report is available in Danish only at www.trafitec.dk/publika.htm. The results of this study were also presented at the Transportation Research Board (TRB) Annual Meeting in January 2008 by Søren Underlien Jensen.[23]

Jensen has also published a before-and-after analysis of blue bike crossings in the U.S. journal *Accident Analysis and Prevention.*[24] This study found that the safety effect depends on the number of blue bike crossings at the intersection. One blue bike crossing reduces the number of intersection crashes by 10 percent. Marking two and four blue bike crossings increases the number of crashes by 23 percent and 60 percent, respectively.

These findings on the safety of cycle tracks and blue bike crossings are acknowledged in Copenhagen's 2006 *Bicycle Account.* That report indicates that the city will experiment with other approaches, including intersection designs that bring bicyclists and motorists physically closer together at intersections. One promising solution includes a cycle track that transitions to an onstreet bike lane at the intersection, with the motor vehicle stop line set back from the bicyclist stop line.

[23] Jensen, Søren Underlien. *Bicycle Tracks and Lanes: A Before-After Study.* Presented at the TRB Annual Meeting, January 2008.

[24] Jensen, Søren Underlien. "Safety Effects of Blue Cycle Crossings: A Before-After Study." *Accident Analysis and Prevention,* Vol. 40, 2008, pp. 742-750.

The SUNflower project[25,26] (http://sunflower.swov.nl/) is a collaboration among the primary road safety research institutes in **S**weden, the **U**nited Kingdom, and the **N**etherlands (Swedish Road and Transport Research Institute, Transport Research Laboratory, and Institute for Road Safety Research, respectively). The traffic safety experience of these three countries is recognized as among the best in the European Union, yet the traffic crash injuries and fatalities were still deemed unacceptably high. A comparative study completed in 2002 assessed the safety strategies of the original three SUN countries. Study results are used to make continued progress in developing safety programs in the three countries. A followup to the initial SUNflower report, SUNflower+6,[27, 28] was completed in 2005 and added six countries to the road safety research collaboration: the Czech Republic, Hungary, Slovenia, Greece, Portugal, and Spain and Catalonia. Pedestrian and bicyclist safety was included in the safety research topics.

Key Findings

Key findings on evaluation are as follows:

- **Many of the foreign hosts provide regular performance reports on pedestrian and bicyclist safety and mobility.** These performance reports measure the agency's progress toward stated goals and outcomes and are used to refine policies and strategies to ensure that goals are met. For example, the city of Copenhagen publishes a Bicycle Account every 2 years that reports on several measures, such as cyclist mode split, safety, and perceived comfort and safety. The most common pedestrian and bicyclist performance measures were usage (e.g., counts, mode share) and safety (e.g., fatalities and serious injuries), which were

[25] *SUNFlower: A comparative study of the development of road safety in Sweden, the United Kingdom, and the Netherlands.* Report 976, ISBN 90-801008-9-7, SWOV, Leidschendam, 2002.

[26] Wegman, F.C.M. *Into a higher gear; Building on SUNflower: a comparative study of Europe's three safest countries: Sweden, the United Kingdom, and the Netherlands.* Report R-2004-3 (Dutch with English summary), SWOV, 2004.

[27] Wegman, Fred, Vojtech Eksler, Simon Hayes, David Lynam, Peter Morsink, and Siem Oppe. *SUNflower+6, A comparative study of the development of road safety in the SUNFLower+6 countries: Final Report.* Report 976, ISBN 978-90-807958-5-3, SWOV Institute for Road Safety Research, 2005.

[28] Morsink, Peter, Siem Oppe, Martine Reurings, and Fred Wegman. *SUNflower+6, Development and application of a footprint methodology for the SUNflower+6 countries.* ISBN 978-90-807958-6-0, SWOV Institute for Road Safety Research, 2005.

CHAPTER 8

Summary of Findings and Implementation Plan

typically reported on an annual basis.

This chapter provides a summary of the findings from the 2009 scanning study and compares these findings to the previous pedestrian and bicyclist scanning study conducted in 1993. The chapter also provides recommendations for implementing these findings.

Summary of Findings

- **Numerous policies and approaches contribute to higher rates of pedestrian and bicyclist safety improvements and higher walking and biking mode splits in the host countries.** From all of the information that the scan team gathered and everything it observed, it appears that higher levels of walking and biking safety and mobility are due to a deliberate combination of policies, approaches, and influences. These policies and approaches are discussed in detail in the report.

- **Many of the foreign hosts have established an urban street user hierarchy that gives the highest priority to walking, biking, and public transit.** The street user hierarchy has been developed to support a range of public policy goals, such as livability, sustainability, public health, climate change, and congestion management. The hierarchy guides decisions on transportation policy, planning, design, operations, and maintenance.

- **"Safety in numbers" (also called "awareness in numbers") is a clear motivator behind the promotion of walking and bicycling as a safety improvement strategy.** Most host countries indicated that they promoted walking and bicycling for a variety of reasons (lower overall transportation delivery cost, sustainability, space and energy efficiency, health and wellness, etc.), and improved safety was often mentioned as one of the outcomes of higher levels of walking and biking. Their rationale is that when pedestrians and bicyclists are a common element in the street environment, motorists expect their presence and take the necessary precautions at potential conflict points, such as when a motorist turns right across a through bicycle lane.

- **The scan team observed several innovative traffic signal features and design practices that have the potential to improve pedestrian safety in the United States.** Several examples are discussed in detail in the report.

- **The scan team observed several approaches and design practices that could be used to improve bicyclist safety in the United States.** Several examples are discussed in detail in the report.

- **The scan team observed the use of low-speed street designs in both residential and commercial areas that were especially conducive to walking and bicycling.** However, several foreign hosts indicated that certain conditions should be met for these low-speed street designs to operate properly: 1) speeds of the different modes should be similar, 2) flows (volumes) of users should be similar, and 3) "see and be seen" is a critical design element.

- **The scan team observed close integration of bicycling and walking considerations with public transit (including intercity rail) that makes longer intermodal commutes by bike practical as well as safer and more convenient.** Several examples are discussed in detail in the report.

- **Many of the foreign hosts have pervasive and widespread traffic safety education programs for children.** The education programs start at an early age and some continue through the teenage years. These traffic safety programs involve participation from a wide variety of organizations, including schools, businesses, civic organizations, police, public health groups, and parks and recreation departments.

- **Bicycle helmet use is encouraged, but not required by law.** The scan team found higher levels of bicycle helmet use than expected in the countries visited. Helmets were uniformly encouraged for children and adults. Most countries emphasized physical activity first and helmets second. Their rationale was that required helmet use discourages bicycling (physical activity), which could have a greater public health detriment than head injuries due to crashes.

- **The scan team observed the widespread use of photo enforcement for traffic signals and speed limits.** Although photo enforcement is viewed primarily as a tool for improving motor vehicle safety, better motorist compliance with speed limits and traffic signals also improves pedestrian and bicyclist safety.

- **Many of the foreign hosts use promotional programs and activities to encourage and enable more walking and biking.** These encouragement activities are seen as a tool to meet modal share goals as well as increase pedestrian and bicyclist safety. Many foreign hosts viewed higher levels of walking and biking as a way to improve safety (the "safety in numbers" effect). Several examples are discussed in detail in the report.

- **Many of the foreign hosts provide regular performance reports on pedestrian and bicyclist safety and mobility.** These performance reports measure the agency's progress toward stated goals and outcomes, and are used to refine policies and strategies to ensure that goals are met. The most common pedestrian and bicyclist performance measures were usage (e.g., counts, mode share) and safety (e.g., fatalities and serious injuries), which were typically reported on an annual basis.

Implementation Plan

Based on the findings summarized in this report, the scan team has developed the following implementation recommendations.

Policy

- **Encourage transportation policy (at national, State, and local levels) that addresses the safety and mobility of walking, biking, and other nonmotorized modes so these modes have the highest priority in the road user hierarchy.** This hierarchy, when integrated with public transit, simultaneously addresses numerous other public policy goals, such as livability, sustainability, public health, climate change, and congestion management. To implement this policy, establish specific and measurable outcomes with performance targets, including usage and safety experience (see the "Evaluation" recommendation). Specific near-term actions include the following:
  - Revising, strengthening, and publicizing the U.S. DOT policy statement *Accommodating Bicycle and Pedestrian Travel: A Recommended Approach.*
  - Conducting a survey of domestic and international best practices on policies that facilitate safety and increased rates of walking and bicycling. Such policies should be examined at Federal, State, and local levels. Examples include Complete Streets policies in the United States, the national bicycling plan for Germany, the United Kingdom Cycling City program, and Swiss legislation on human-powered mobility.
  - Developing a national strategy to improve education for transportation professionals on walking and bicycling design and planning.
  - Completing a new *National Bicycling and Walking Study* that sets new mode share and safety targets for walking and bicycling.

Engineering

- **Evaluate and consider implementation of innovative signal features and geometric designs to improve pedestrian safety at street crossings.** Examples of pedestrian features that can be implemented now are as follows:
  - Raised crosswalks at pedestrian crossings (applied at midblock and roundabouts)
  - Passive detection of pedestrians in waiting areas and crosswalks to extend or cancel the pedestrian phase
  - Accessible pedestrian signals with confirmation lighting
  - Crossing islands at pedestrian crossings, even on narrow roadway widths
  - Partial crossings at wide signalized intersections with wide medians (note that additional push buttons and pedestrian signals will be required)

  Examples of pedestrian features that could be implemented in the short term with appropriate evaluation are as follows:
  - Near-side pedestrian signal heads that encourage viewing oncoming traffic
  - Passive detection of pedestrians in waiting areas and

crosswalks to truncate the pedestrian phase

- **Evaluate and consider implementation of innovative strategies to improve bicyclist safety.** Examples of bicyclist features that can be implemented now are as follows:
  - Convex mirrors
  - Right-turn-on-red car restrictions
  - Advance stop lines for bicyclists
  - Continuation of bike lanes up to intersections
  - Bike lanes between traffic lanes
  - Shared bike lanes and right-turn lanes
  - Bike routes on lower volume parallel roadways
  - Contraflow bicycle lanes
  - Path user divisions
  - Dashed bike lanes through intersections
  - Rotated or longitudinal bicycle symbols at driveways

  Examples of bicyclist features that would likely require evaluation are as follows:
  - Cycle tracks
  - Accommodating two-stage left turns at signalized intersections
  - Dashed bicycle lanes on narrow roadways
  - Railing separating pedestrians and bicycles at intersections
  - Colored lanes at conflict points
  - Reserving yellow for bicycle and pedestrian pavement markings

- **Evaluate the applicability of lower speed street designs in residential and commercial zones.** The evaluation should address the differences in application between residential and commercial areas, and should more clearly define implementation issues and application criteria for the design of low-speed streets in the United States that are practical, safe, and efficient for all road users.

- **Develop guidance on best practices for integrating bicycle and pedestrian considerations into public transit, including intercity rail.** These considerations include permitted times of bike boarding, bike parking, bikes on trains and buses, and bike sharing (e.g., city bike) programs. Two existing documents may partially address this need: *Transit Cooperative Research Program Synthesis 62–Integration of Bicycles and Transit* (2005) and *Pedestrian Safety Guide for Transit Agencies* (FHWA-SA-07-017). Based on a review of these documents, a best-practices guide may be desirable that includes any strategies observed during the scan that were not part of the two reports. Once a suitable guide has been identified or developed, Web conferences and other training should be provided to transportation and transit engineers and planners.

Education

- **Institutionalize ongoing traffic safety education that starts at an early age, including knowledge and skill-based learning.** Safety education programs can be multifaceted and include a variety of agencies and organizations for optimal delivery. To accomplish this, a national set of bicycle and pedestrian education standards and curriculum should be developed that establishes the minimum amount of information to be included and at what ages. The curriculum should incorporate practical applications of this safety information in safe settings such as a mock pedestrian crossing or the traffic garden concept.

- **Unify all traffic safety campaigns (including bicycle and pedestrian safety) under a single national brand.** For example, the United Kingdom's Department for Transport has developed a road safety program called THINK! that includes educational materials for numerous safety focus areas. To accomplish this, the U.S. DOT should develop a single brand and require that it be included on all highway safety educational and communication materials it produces. U.S. DOT highway safety materials are disseminated through a wide number of partners, including national associations, State and local governments, law enforcement agencies, medical organizations, public health departments, vehicle manufacturers, and insurance companies.

Enforcement

- **Promote the use of photo enforcement as a tool to improve pedestrian and bicyclist safety.** FHWA and NHTSA already promote photo enforcement, and their Web sites (http://safety.fhwa.dot.gov/index.cfm and http://safety.fhwa.dot.gov/speedmgt) have extensive information on implementing speed and red-light-running campaigns.

Encouragement

- **Develop and implement programs that encourage and enable regular walking and biking.** Examples of these strategies include the following:
  - Web-based route planning
  - Walking and biking maps
  - Social marketing campaigns

- Shared bike programs for the public or municipal employees

Evaluation

- **Develop and implement a performance monitoring and reporting program that annually measures progress toward stated goals and outcomes.** Key performance measures are usage and safety experience. Other measures include pedestrian and bicyclist facility condition and extent (e.g., mileage). Existing count and safety evaluation efforts (Alliance for Biking and Walking's *Bicycling and Walking in the U.S. Benchmarking Report,* Alta/Institute of Transportation Engineers National Bicycle and Pedestrian Documentation Program, FHWA's *National Bicycling and Walking Study*) should be better coordinated and unified. National guidance should be given on a consistent format and a sampling strategy to develop national estimates. Additionally, the 1994 *National Bicycling and Walking Study* should be updated to reflect current conditions and renew or reestablish national goals for bicycling and walking safety and usage.

APPENDIX A

Amplifying Questions

In 2007, there were 4,654 pedestrian and 698 bicyclist deaths in the United States, accounting for 13 percent of all U.S. highway fatalities. The Federal Highway Administration's (FHWA) Office of Safety has established pedestrian and bicyclist safety as one of its top priorities. Two other priorities, intersection safety and speed management, are issues that also significantly affect pedestrians and bicyclists. The American Association of State Highway and Transportation Officials (AASHTO), a member association of State transportation departments, has identified two of the top 10 goals in its Strategic Highway Safety Plan as "making walking and street crossing safer" and "ensuring safer bicycle travel."

FHWA has launched two new programs targeted at increasing pedestrian and bicyclist travel and improving safety. Safe Routes to School is a $612 million national program with the majority of funds devoted to infrastructure improvements. The Nonmotorized Pilot Program, which provides $100 million to four communities to improve bicycling and walking facilities, aims to evaluate how improved walking and biking facilities can carry a significant portion of the urban transportation load.

It has become increasingly important to both FHWA and AASHTO to improve nonmotorist safety and mobility. The purpose of this scanning study is to visit countries that are leaders in innovation for pedestrian and bicyclist safety policies and infrastructure. The following are specific topics of interest:

- **Improving pedestrian and bicyclist safety**—Approaches (engineering, education, and enforcement) that have been successful in improving pedestrian and bicyclist safety. These approaches can include both infrastructure and policy.
- **Safe routes to school programs**—Approaches and policies for improving safety for child pedestrians and bicyclists, especially those that support programs like Safe Routes to School.
- **Monitoring usage levels and exposure**—Quantitative methods of monitoring pedestrian and bicyclist usage levels (for example, counts and surveys) and exposure to crashes.
- **Safety research and evaluation**—Recently completed or ongoing research and collaboration opportunities in pedestrian and bicyclist safety.

Where possible and appropriate, the panel is interested in site visits (for example, walking and bicycling tours) to directly observe pedestrian and bicyclist facilities and their operation.

TOPIC 1: Improving Pedestrian and Bicyclist Safety

Describe approaches (engineering, education, and enforcement) that have been successful in improving pedestrian and bicyclist safety. These approaches can include both infrastructure and policy.

1. What are your pedestrian and bicyclist fatalities and crash rates nationwide? By metropolitan area? In rural areas? Please elaborate on trends and patterns.
2. What are the most common types of pedestrian and bicyclist crashes in your country, region, or city? What is being done to address these types of problems?
3. What safety countermeasures are most useful in situations in which the volume of bicyclists and pedestrians is lower?

Engineering

4. Describe the typical ways pedestrian and bicyclist infrastructure is developed. For example, does transport policy explicitly require the accommodation of all modes? Are there objective criteria or warrants to determine which facilities will be provided or improved?
5. Describe the typical funding practices for pedestrian and bicyclist infrastructure and programs. Are pedestrian and bicycle safety improvements funded as part of road projects or special safety enhancement programs?
6. What processes or procedures are used to identify safety problems? For example, are safety audits, crash analyses, or other objective criteria used on a regular basis?
7. Are design standards developed at the national level or locally? If national, can they be modified by local agencies based on conditions? What is that modification process?

8. Describe typical design practices and standards for pedestrian and bicyclist facilities. For bicyclists, is there a philosophy of separation from motor vehicle traffic, or does it depend on the context (urban versus rural)? For example, do you have guidelines on maximum auto speed or roadway characteristics that determine when to provide onstreet versus separated bicycle facilities?
9. Describe specific intersection design features and characteristics for cycling, such as contrasting color pavements, advance stop lines, or bicycle-specific traffic signals.
10. What types of safety improvements are made at signalized intersections for pedestrians? Examples may include leading pedestrian intervals, right-turn-on-red restrictions, exclusive pedestrian phasing, and extended crossing time for slower crossings.
11. Describe typical designs and traffic control devices used at uncontrolled (unsignalized) pedestrian crossings. For example, do criteria or warrants exist for marked crosswalks (zebra crossings), flashing beacons, or other devices that serve infrequent pedestrian demand?
12. Is automated pedestrian detection commonly used and, if so, at what locations? What technologies work best? What are maintenance issues or costs?
13. Describe typical lighting practices for pedestrian street crossings. Are these used at all crossings or just high-demand crossings?
14. How are bicyclists' needs and concerns addressed on the use of shoulder and centerline rumble strips?
15. What has been the safety experience for pedestrians and bicyclists at roundabouts? Are any particular techniques employed for persons with disabilities?
16. How is pedestrian and bicyclist safety addressed on one-way streets? For example, are contraflow bike lanes or special pavement markings used?
17. Describe typical traffic-calming or street design practices that support walking and bicycling. In particular, what practices are used in snowy climates? What is your experience with shared space and removing traffic control signage (e.g., Hans Monderman's "naked streets")?
18. How are innovative treatments or designs evaluated before being widely implemented?
19. Are there national or local laws or ordinances for accessible design for users with disabilities? If not, what is the typical practice? Do design parameters address older road users, particularly older pedestrians?
20. Who has maintenance responsibility for separated bikeways, and how is it accomplished?
21. How do you know when pedestrian and bicyclist infrastructure needs to be upgraded or replaced?

Education

22. Describe typical safety education practices for pedestrians and bicyclists. For example, who provides funding? At what age does education occur? What safety messages are communicated and how? Are motorists included?
23. What training and education do engineers, planners, police, and other professionals receive on pedestrian and bicycle safety? How much is provided in colleges and universities versus ongoing training opportunities?

Enforcement

24. What laws exist that provide for pedestrian and bicyclist safety? How are they enforced? For example, are they enforced routinely or in special campaigns?
25. Is automated enforcement used and, if so, for what laws?
26. What enforcement programs have been implemented to address driver behavior and compliance with pedestrian- and bicyclist-related laws (right-of-way, due care, etc.)? Were they effective?
27. What enforcement programs have been implemented to address pedestrian and bicyclist behavior and compliance with laws? Were they effective?
28. Describe the typical level of cooperation and courtesy between motorists and bicyclists. For example, does your country or city have a problem with "road rage" between autos and bikes? If so, what has been done to address it?

TOPIC 2: Safe Routes to School Programs

Describe approaches and policies for improving safety for child pedestrians and bicyclists, especially those that support programs like Safe Routes to School.

29. What percentage of children walk or bike to school? What actions have occurred to increase or decrease these percentages?
30. What percentage of walking and cycling fatalities are considered children? What are you doing to address this?
31. What research is underway to address child walking and biking safety?
32. Does your city or region have a Safe Routes to School program? If so, please describe. For example, what age ranges does it include? How is it funded? Are data collected to evaluate results?
33. Has your area dealt with increasing school bus and private auto use for transporting kids to school because of parents' concerns about child safety (e.g., unsafe roads or no sidewalks) and security (e.g., child kidnapping,

molestation)? If so, how have you addressed these concerns?

34. What type of bicycle facility is used to accommodate young bicyclists? In the United States, for example, young cyclists typically ride on the sidewalk.

TOPIC 3: Monitoring Usage Levels and Exposure

Describe quantitative methods of monitoring pedestrian and bicyclist usage levels (e.g., counts and surveys) and exposure to crashes.

35. Is bicyclist and pedestrian travel monitored? If so, describe techniques (household survey, screenline counts, etc.), equipment used, how often, how long, how many locations, etc.
36. How have rates of walking and bicycling changed in your country over the last several decades? What factors contributed to any changes? Do safety statistics improve as usage increases (i.e., "safety in numbers")?
37. What is the typical reporting threshold for pedestrian and bicyclist crashes? Is there an issue with underreporting? If so, how is it addressed?
38. Are bicyclist and pedestrian safety exposure rates calculated and/or reported? If so, how is exposure defined? By population? By number of trips? By estimated travel distance?

TOPIC 4: Safety Research and Evaluation

Describe recently completed or ongoing research and collaboration opportunities in pedestrian and bicyclist safety.

39. Are you participating in international research or collaboration on pedestrian and bicyclist safety? If so, please describe.
40. In what ways can the United States work with your agency or organization to share and/or collaborate on pedestrian and bicyclist research?
41. Are you aware of research and development initiatives in the auto industry to improve pedestrian and bicyclist safety, such as crash survivability standards for autos and infrared pedestrian detection on auto dashboard displays?

APPENDIX B

Scanning Study Itinerary and Meeting Schedule

DATE	CITY	HOST AGENCIES
Saturday, May 9, 2009	Travel Day	
Sunday, May 10	Copenhagen, Denmark	Scan Team Organization Meeting
Monday, May 11	Malmö and Lund, Sweden	Swedish Road Administration Swedish Road and Transport Research Institute Lund University City of Malmö City of Lund
Tuesday, May 12	Copenhagen, Denmark	Danish Road Directorate City of Copenhagen
Wednesday, May 13	Nakskov, Denmark	City of Nakskov Lolland CTF (Community Testing Facilities)
Thursday, May 14	Berlin, Germany	Berlin Senate Department for Urban Development
Friday, May 15	Potsdam, Germany	City of Potsdam Potsdam University of Applied Sciences
Saturday, May 16	Travel Day	
Sunday, May 17	Bern, Switzerland	Scan Team Midtour Meeting
Monday, May 18	Bern, Switzerland	Swiss Federal Roads Office City of Bern
Tuesday, May 19	Winterthur, Switzerland	City of Winterthur
Wednesday, May 20	London, United Kingdom	Department for Transport
Thursday, May 21	London, United Kingdom	Transport for London
Friday, May 22	Bristol, United Kingdom	City of Bristol NHS Bristol (National Health Services)
Saturday, May 23	London, United Kingdom	Scan Team Final Meeting
Sunday, May 24	Travel Day	

APPENDIX C|

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APPENDIX D

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Biographical Information

Edward L. Fischer (AASHTO cochair) is State traffic engineer and State roadway engineer for the Oregon Department of Transportation (ODOT). As the manager of the Traffic-Roadway Section, Fischer is responsible for ODOT's Bicycle and Pedestrian program, which administers more than $5 million a year in bicycle and pedestrian improvements in Oregon. By statute, 1 percent of highway funds in Oregon must be used for construction and maintenance of bike trails and foot paths. As State traffic engineer, Fischer must approve all new traffic control devices on State highways in Oregon, including crosswalks. He leads the Oregon Traffic Control Devices Committee, which establishes traffic control standards for the State. He is a member of ODOT's Research Advisory Committee, which determines how transportation research funds are directed. Fischer has more than 30 years of experience in traffic and transportation engineering in the public and private sectors. Before becoming the State traffic engineer, he worked for the Federal Highway Administration (FHWA), the U.S. Forest Service, and a consulting firm in Seattle, WA. He has bachelor's and master's degrees in engineering from Oregon State University. He is a member of the Institute of Transportation Engineers (ITE), the National Committee on Uniform Traffic Control Devices, the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Traffic Engineering, and the AASHTO task force on U.S. Bicycle Routes.

Dr. Gabe K. Rousseau (FHWA cochair) is the U.S. Department of Transportation (U.S. DOT) and FHWA Bicycle and Pedestrian Program manager. He oversees Federal bicycle and pedestrian guidance and policy, manages pedestrian and bicycle research, and is the program manager for the Nonmotorized Transportation Pilot Program. He serves on the Transportation Research Board's (TRB) Pedestrian Committee and the Organization for Economic Cooperation and Development Working Group on Pedestrian Safety, Urban Space, and Health. Rousseau is also the secretary for the AASHTO Joint Technical Committee on Nonmotorized Transportation. He has worked on pedestrian and bicycle safety outreach and research for the past 7 years. He has a Ph.D. in experimental psychology (human factors) and is a member of the Association of Pedestrian and Bicycle Professionals (APBP), ITE, and the Human Factors and Ergonomics Society.

Shawn M. Turner (report facilitator) is a research engineer for the Texas Transportation Institute (TTI) in

College Station, TX. Turner conducts and manages pedestrian and bicyclist research projects for several different research sponsors. His recent research has been related to pedestrian and bicyclist safety and behavioral evaluations, usage monitoring, and planning methods and tools. In his 17 years at TTI, Turner has been involved in a variety of pedestrian and bicyclist activities, from advising Federal agencies on a national research agenda to lecturing in university courses on pedestrian and bicycle transportation to instructing bicycle safety classes in his community. Turner received degrees in civil engineering from Pennsylvania State University and Texas A&M University. He is a licensed professional engineer in Texas and a league cycling instructor with the League of American Bicyclists. He chairs the TRB Pedestrian Committee and is a member of its Urban Data and Information Systems Committee.

Ernest (Ernie) J. Blais is the division administrator for the FHWA Vermont Division in Montpelier, VT. Blais oversees an annual Federal-aid program of about $200 million in Vermont. He provides leadership and guidance to State and local officials in the identification of surface transportation needs and related priorities in carrying out national transportation program goals. Blais has worked with FHWA for more than 35 years, serving as the FHWA bicycle coordinator in Ohio for more than 15 years. Blais has a bachelor's degree in civil engineering from the University of Massachusetts, Dartmouth. He is a licensed professional civil engineer in California and a member of the American Society of Civil Engineers (ASCE).

Cindy L. Engelhart is a bicycle pedestrian transportation engineer with the Northern Virginia District of the Virginia Department of Transportation. She serves as the district's technical bicycle and pedestrian design expert. Her emphasis is on providing bike and pedestrian technical assistance on the State's megaprojects (larger than $100 million), including writing draft procedures for evaluating public-private partnership (PPP) project proposals, reviewing maintenance of traffic plans, providing technical verbiage for innovative PPP project contracts, and reviewing asset management agreements. She is a licensed civil engineer with 26 years of transportation design experience in bridges, highways, drainage, and bike and pedestrian issues. In the bike and pedestrian field, she has served on several State policy task forces and reviewed numerous manual revisions. Engelhart graduated from Louisiana State University. She is a member of the Bicycle Technical Committee and the Pedestrian Task Force of the National Committee on Uniform Traffic Control Devices.

David R. Henderson is the bicycle/pedestrian coordinator for the Miami-Dade County Metropolitan Planning Organization (MPO). He works with State and local agencies to identify, plan, and fund projects and programs that increase walking and bicycling mobility and safety. Henderson manages nonmotorized planning studies funded through the Unified Planning Work Program, provides staff support to the MPO's Bicycle/Pedestrian Advisory Committee, and updates the bicycle and pedestrian elements of the Long Range Transportation Plan and Transportation Improvement Program. Previously, he worked as a transportation planner for the Florida Department of Transportation. Henderson has a bachelor's degree in economics from Indiana University and a master's of urban and regional planning from the University of Miami. He is a member of the American Institute of Certified Planners, APBP, and the Florida Bicycle Association board of directors.

Jonathan (Jon) A. Kaplan is the Bicycle and Pedestrian Program manager at the Vermont Agency of Transportation (VTrans). Kaplan is the agency's prime point of contact for technical issues related to designing transportation projects to accommodate bicycle and pedestrian travel. Kaplan is also responsible for statewide efforts to encourage bicycling and walking and to compile data about the use and safety of these two nonmotorized modes. He is developing an updated statewide program to provide education to all roadway users on how to interact safely on the State's roadways. Previously, he was the Vermont Safe Routes to School coordinator. Before joining VTrans, Kaplan worked as a senior transportation planner with the Southern Windsor County Regional Planning Commission, a project engineer with the Vermont consulting firm DuBois & King, and the bicycle and pedestrian specialist with the Oregon Department of Transportation. Kaplan has a bachelor's degree in civil engineering from Worcester Polytechnic Institute. He is a licensed civil engineer in Vermont and a member of ITE and APBP.

Vivian M. (Kit) Keller is the executive director of the Association of Pedestrian and Bicycle Professionals. As one of APBP's two representatives to the America Bikes Coalition, Keller frames issues and goals for future transportation legislation in the United States (e.g., raise the profile of bicycling and walking as a solution to physical inactivity, traffic congestion, and climate change). APBP is studying the planning model of Vancouver British Columbia, Canada: pedestrians first, then transit users and bicyclists, then the movement of goods, and finally the private automobile

(2008 Townmaking Tour led by Dan Burden and the California Local Government Commission). Keller is a bicycle safety instructor (League of American Bicyclists) and has facilitated more than 25 Walkable Community workshops. She is a graduate of Valparaiso University in Indiana (social work, psychology, and political science) and earned a doctor of jurisprudence degree from the Indiana University School of Law in Indianapolis. Keller is a former local elected official and planning commissioner. As a member of the American Public Health Association, she is interested in applying health impact assessments to transportation.

James D. Mackay is a project engineer for the Denver Public Works Department (but participated in the scanning study in his personal capacity). Mackay is involved with municipal and federally funded projects such as constructing bicycle and pedestrian bridges; constructing streets, sidewalks and pedestrian lighting; and rehabilitating street underpasses. Previously, he was Denver's bicycle planner for 17 years and the North Carolina Department of Transportation's bicycle facilities engineer for 3 years. He graduated from Southern Illinois University with a bachelor's degree in civil engineering technology and from Manatee Junior College with an associate's degree in journalism. He is a licensed professional engineer. He is a member of the ITE delegation to the National Committee on Uniform Traffic Control Devices, ASCE, the American Society for Testing and Materials, and APBA.

Priscilla A. Tobias is the State safety engineer for the Illinois Department of Transportation (IDOT) in Springfield, IL. Tobias directs and administers IDOT's integrated safety engineering program and implementation of Illinois' Comprehensive Highway Safety Plan, which includes pedestrian and bicycle safety and an annual statewide safety program of more than $50 million. She serves on the Chicago Mayor's Pedestrian Advisory Council and IDOT's Safe Routes to School Implementation Committee. Tobias has more than 17 years of professional experience in transportation engineering in the public sector, including developing and implementing engineering policy and safety initiatives. She has a bachelor's degree in civil engineering from Virginia Polytechnic Institute and State University. She is a member of the AASHTO Standing Committee on Highway Traffic Safety and the AASHTO Subcommittee on Safety Management (SM), is the chair of the SM Task Group for Vulnerable Users (pedestrians, bicyclists, and motorcyclists), is the vice chair of the Joint Task Group for the Highway Safety Manual, and serves on National Cooperative Highway Research Program panels.

Diane E. Wigle is chief of the Safety Countermeasures Division of the National Highway Traffic Safety Administration in Washington, DC. She is responsible for planning and developing behavioral safety programs addressing pedestrian, bicycle, older driver, motorcycle, and pupil transportation safety, in addition to Safe Routes to School programs. She works closely with FHWA to develop and coordinate pedestrian and bicycle safety policies and programs. She served as the U.S. DOT's liaison to the U.S. Access Board and in that capacity was chair of the Public Rights-of-Way Committee. She received a bachelor's degree in secondary education from Central Michigan University and a master's of public administration from Eastern Michigan University.

Charlie V. Zegeer is the associate director of the University of North Carolina's Highway Safety Research Center. He is also the director of the FHWA-funded Pedestrian and Bicycle Information Center, where he is responsible for overseeing pedestrian and bicycle research and providing technical information through Web sites, training courses, and user guides related to pedestrians and bicyclists. Zegeer has served as the principal investigator on dozens of studies on safer facilities for motorists, pedestrians, and bicyclists, and he has authored more than 150 reports, user guides, and publications on highway safety. He received a bachelor's degree in civil engineering from Virginia Polytechnic Institute and State University and a master's degree in civil engineering (transportation specialty) from the University of Kentucky. He is an emeritus member of the TRB Pedestrian Committee and past chair of the ITE Committee on Design and Safety for Pedestrian Facilities. He is the winner of TRB's R. Grant Mickle award and the newly created Pat Waller award. He is a registered professional engineer in Michigan.

APPENDIX E|

Internet Resources for Pedestrian and Bicyclist Safety

Scanning Study Host Countries

General European

European Cyclists' Federation | www.ecf.com

European Network for Cycling Expertise | www.velo.info

International Federation of Pedestrians | www.pedestrians-int.org

Walk21 | www.walk21.com

European Road Safety Observatory | www.erso.eu

Sweden

Swedish Road Administration | www.vv.se

Swedish Road and Transport Research Institute | www.vti.se

Lund University | www.tos.lth.se

City of Malmö, Sweden | www.malmo.se

City of Lund, Sweden | www.lund.se

Denmark

Danish Ministry of Transport | www.trm.dk

Danish Road Directorate | www.hvu.dk

City of Copenhagen, Denmark | www.kk.dk

Copenhagen, City of Cyclists | www.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/Services/Mobility/CityOfCyclists.aspx

Copenhagen Blog | www.copenhagenize.com

City of Nakskov, Denmark | www.lolland.dk

Danish Transport Research Institute | www.transport.dtu.dk

Germany

Berlin Senate Department for Urban Development | www.stadtentwicklung.berlin.de

City of Potsdam, Germany | www.potsdam.de

Potsdam University of Applied Sciences | www.fh-potsdam.de

Federal Ministry of Transport, Building, and Urban Affairs | www.bmv.de/en

German National Cycling Plan | www.nrvp.de

National German Bicycle Club (Allgemeiner Deutscher Fahrrad-Club) | www.adfc.de

Switzerland

Swiss Federal Roads Office | www.astra.admin.ch, www.langsamverkehr.ch

City of Bern, Switzerland | www.bern.ch

City of Winterthur, Switzerland | www.stadt.winterthur.ch

Switzerland Mobility | www.switzerlandmobility.ch

United Kingdom

Department for Transport | www.dft.gov.uk

Transport for London | www.tfl.gov.uk

City of Bristol, United Kingdom | www.bristol.gov.uk

Cycling England | www.cyclingengland.co.uk

Cycling Scotland | www.cyclingscotland.org

Walk England | www.walkengland.org.uk

Sustrans | www.sustrans.org.uk

Living Streets | www.livingstreets.org.uk

Transport Research Laboratory | www.trl.co.uk

Children's Traffic Club | www.trafficclub.co.uk

Bikeability | www.bikeability.org.uk

United States

Pedestrian and Bicycle Information Center (PBIC) | www.pedbikeinfo.org

PBIC Walking Site | www.walkinginfo.org

PBIC Bicycling Site | www.bicyclinginfo.org

PBIC Image Library | www.pedbikeimages.org

Federal Highway Administration (FHWA) Bicycle and Pedestrian Program | www.fhwa.dot.gov/environment/bikeped/

FHWA Office of Safety | safety.fhwa.dot.gov/ped_bike/

FHWA Safety Research | www.tfhrc.gov/safety/pedbike/

National Highway Traffic Safety Administration | www.nhtsa.gov/

National Center for Safe Routes to School | www.saferoutesinfo.org/

National Center for Bicycling and Walking | www.bikewalk.org/

Alliance for Biking and Walking (formerly Thunderhead Alliance) | www.peoplepoweredmovement.org

America Walks | www.americawalks.org/

League of American Bicyclists | www.bikeleague.org/

Association of Pedestrian and Bicycle Professionals | www.apbp.org

American Association of State Highway Transportation Officials Joint Technical Committee on Nonmotorized Transportation | design.transportation.org/?siteid=59&pageid=761

National Committee on Uniform Traffic Control Devices Bicycle Technical Committee | members.cox.net/ncutcdbtc/

Transportation Research Board Committee on Pedestrians | www.walkinginfo.org/trbped/

Transportation Research Board Committee on Bicycle Transportation | www.bicyclinginfo.org/trbbike/

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