

# Improving Safety and Mobility for Older Road Users in Australia and Japan



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U.S. Department of Transportation  
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IN COOPERATION WITH

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16. Abstract <i>Age-related declines in vision, cognition, and physical ability affect how older road users drive and use other transportation modes. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study to assess infrastructure improvements designed to aid older road users in Australia and Japan.</i>  <i>The scan team found that using a systems approach provides for integration of safety of older roads users and that enhancing safety for older road users improves safety for all. The team also observed engineering, policy, and educational programs that can improve the safety and mobility of older road users.</i>  <i>Team recommendations for U.S. implementation include integrating information from the scan on infrastructure improvements benefiting older road users into relevant U.S. documents, encouraging partnerships between government and nongovernment organizations to address older road users' needs, and developing a research program on policies and interventions targeted to older road users.</i>			
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# Improving Safety and Mobility for Older Road Users in Australia and Japan

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**U.S. Department of Transportation**

**American Association of State  
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**National Cooperative Highway  
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**October 2008**

# 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 for 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 75 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.

Scan reports can be obtained through FHWA free of charge by e-mailing [international@dot.gov](mailto:international@dot.gov). Scan reports are also available electronically and can be accessed on the FHWA's Office of International Programs Web site at [www.international.fhwa.dot.gov](http://www.international.fhwa.dot.gov).



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# Executive Summary

In March 2008, a scan team of nine transportation safety, traffic engineering, and human factors experts from the United States visited Australia and Japan to assess and evaluate infrastructure improvements designed to aid older road users. The team met with state and federal government transportation officials, university research centers, and staff from motorists' clubs and other nongovernmental organizations interested in the mobility of older people. The team selected these countries to visit because they have demographics and aging trends similar to those in the United States and strong traffic safety records. From the information the team obtained during the scanning study, it identified several planning, design, and operational changes that could be implemented in the United States to improve the mobility and safety of older road users.

The team highlighted the following findings from the scanning study:

- ▶ The aging of society is a global issue. Transportation providers in developed countries worldwide will face a common set of issues because of the aging of transportation system users.
- ▶ Highway safety must be emphasized at the highest levels of government to build political will to implement system changes that benefit older road users.
- ▶ Local government involvement in implementing safety plans is critical for success.
- ▶ A systems approach to highway safety is most effective. This involves engineering, education, enforcement, and evaluation.
- ▶ Infrastructure and operational changes hold great promise for improving safety for older road users.
- ▶ Historical safety data are used in the countries studied, particularly Australia, for planning, policy development, and program evaluation.
- ▶ Improving safety for older road users improves safety for all and vice versa.
- ▶ Removing driving privileges prematurely has unintended consequences, such as forcing users to less safe modes of transport.
- ▶ Mobility options are critical for continued quality of life in terms of physical and mental health outcomes.

A subgroup of the scan team was tasked with identifying items that could be implemented in the United States. The findings of this scanning study will be implemented through the following activities:

- ▶ Enhancement of U.S. roadway design and operations practice through incorporation of best practices and research findings into standards, guidelines, and handbooks used by transportation professionals
- ▶ Outreach to nontraditional partners, such as motoring clubs, health-care providers, and seniors' organizations, to promote self-assessment for drivers and education about mobility alternatives to driving
- ▶ Encouragement of a targeted research program to evaluate specific infrastructure improvements observed in these countries that show promise to aid older road users
- ▶ Establishment of development guidelines for use by local government and real estate developers to promote best practices for access and use by older residents



# Background

In March 2008, a team of nine transportation safety, traffic engineering, and human factors experts from the United States visited Australia and Japan to assess and evaluate infrastructure improvements designed to aid older road users. The scan team members sought policy options and initiatives on transportation system planning, operations, and design as they relate to older road users. The group met with state and federal government transportation officials, university research centers, and staff from motorists' clubs and other nongovernment organizations interested in the mobility of older people. Although the scan focused on infrastructure improvements, the team also learned about policies for older road user training, assessment, and licensing. In addition, general road safety programs were discussed with all agencies visited. The majority of these programs provided a benefit to older road users, although they may not have been designed specifically with this user group in mind. The converse of this is true as well; programs and policies developed for older road user safety and mobility will improve transportation for all users. From the information the team obtained during the study, it identified several planning, design, and operational changes that could be implemented in the United States to improve the mobility and safety of older road users.

This scanning study was conducted under the auspices of the Federal Highway Administration's (FHWA) Office of International Programs, which focuses on meeting the growing demands of its partners at the Federal, State, and local levels for access to information on state-of-the-art technology and best practices used worldwide. As part of this office, the Technology Exchange Program accesses and evaluates innovative foreign technologies and practices that could significantly benefit U.S. highway transportation systems.<sup>(1)</sup> The main avenue for accessing foreign innovations is the International Technology Scanning Program. The program is undertaken jointly with the American Association of State Highway and Transportation Officials (AASHTO) and its Special Committee on International Activity Coordination in cooperation with the Transportation Research Board's NCHRP Project 20-36 on "Highway Research and

Technology—International Information Sharing" the private sector, and academia.

The older road user scan team began its planning effort in September 2007 with the completion of a desk scan that recommended Australia and Japan as the two countries to visit during the trip. The initial team meeting occurred in October 2007 in Washington, DC, and the trip took place February 28 through March 16, 2008.

## Purpose

By the year 2020 more than 50 million Americans will be age 65 and older, and by the year 2050 roughly 80 million adults will be in this age category.<sup>(2)</sup> Throughout the presentations and discussions with the host countries, it was clear that the graying of the population is not a demographic phenomenon limited to the United States. The scan team chose to visit Australia and Japan because of similar demographics, strong safety records, and coordinated safety implementation programs. In particular, Australia uses strategic safety plans across all levels of government. And in Japan the preparatory research showed pedestrian and transit infrastructure aimed at improving mobility for older users.

In Japan, the growth rate in the proportion of population over age 65 is much higher than in the United States. By 2030, 30 percent will be over 65, compared to 20 percent in the United States.<sup>(3,4)</sup> In Australia in 2030, demographers predict that 21.5 percent of the population will be over age 65.<sup>(5)</sup> Australia has seen a remarkable reduction in fatalities over the previous three decades from a start point of 30.4 fatalities per 100,000 in 1970 to 7.77 per 100,000 in 2006.<sup>(6)</sup> Japan's traffic fatality rate is also a relatively low 6.7 per 100,000 people. These numbers compare to the U.S. traffic fatality rate of 14.24 per 100,000 people.<sup>(7)</sup>

It is well established that age-related declines in vision, cognition, and physical abilities affect how older road users drive and use other transportation modes. As former U.S. Transportation Secretary Norman Mineta wrote in a *Public Roads* magazine editorial, "Without additional



attention to the needs of older citizens, the United States faces critical national impacts not only in terms of transportation safety, but also for the independence and mobility of the senior population. The specialized needs of older road and transit users will place new demands and strains on America's transportation system."<sup>(8)</sup> Engineering-based countermeasures are being developed and implemented in the United States and abroad to minimize the impact of these ability changes.<sup>(9)</sup>

The U.S. Department of Transportation has a multitude of programs devoted to the integration of older road user needs involving the full spectrum of transportation systems.<sup>(10)</sup> However, the focus of this scan was on the implementation of infrastructure improvements for older road users. Many countries, including the United States and Australia, have published documents detailing how the physical, perceptual, and cognitive changes associated with aging affect a person's ability to use the existing transportation system.<sup>(11,12,13)</sup> These documents include recommendations for improvements to infrastructure and operations to address the needs of older road users, but few have reported on the successful implementation of these recommendations.

The scan team also investigated policy initiatives on transportation system planning, operations, and design as they relate to older road users. The role of older road users in road safety programming, funding, prioritization, and evaluation was also discussed with all of the government agencies. The scope of this project specifically excluded driver licensing and remedial training programs, but the team took the opportunity to learn about innovative policies in these areas used in Australia. As a recent U.S. Government Accountability Office report notes, knowledge sharing between the United States and other countries can help the United States prepare for the increase in the proportion of older road users as the baby boom demographic bubble moves toward retirement in the coming years.<sup>(2)</sup>

## Organization of Report

The scan report is organized by topic, rather than by itinerary. One key theme is that improvements made to transportation infrastructure, policy, and services to aid older users results in improvements for all users. For this reason, the first section of the report focuses on general strategic safety planning and evaluation in Australia and Japan. A systems approach to improving safety

benefits all users. This systems approach is present in both policy and engineering. The report continues with specific examples of infrastructure improvements to roadways, walkways, and transit systems aimed at older road users. Later sections present information on licensing, evaluation, and mobility options for citizens after they have ceased driving. The report concludes with recommendations for short- and long-term implementation in the United States.

## Scan Team Members

The nine team members included transportation agency personnel from three States, university researchers, and representatives of an association of metropolitan planning organizations (MPOs) and FHWA. The following were on the team:

- ▶ **Elizabeth Alicandri (FHWA cochair)**, director, Office of Safety Programs, FHWA
- ▶ **Pamela Hutton (AASHTO cochair)**, chief engineer, Colorado Department of Transportation (DOT)
- ▶ **Dr. Susan T. Chrysler (report facilitator)**, senior research scientist, Texas Transportation Institute
- ▶ **Dr. Leanna Depue**, director, Highway Safety Division, Missouri DOT
- ▶ **Howard M. Glassman**, executive director, Florida Metropolitan Planning Organization Advisory Council
- ▶ **Dr. Thomas M. Granda**, team leader, Human Centered Systems Team, FHWA
- ▶ **David L. Harkey**, director, University of North Carolina Highway Safety Research Center



**Figure 1.** Older road users scan team in Tokyo, Japan (from left to right, Barry Warhoftig, Susan Chrysler, Thomas Granda, Pamela Hutton, Thomas Smith, Leanna DePue, Howard Glassman, Elizabeth Alicandri, and David Harkey).

- ▶ **Thomas J. Smith**, *administrator, West Virginia Division, FHWA*
- ▶ **Barry I. Warhoftig**, *director, Traffic Engineering, West Virginia DOT*

## Issues of Interest

The purpose of this scan was to collect information from abroad with the potential to improve roadway safety and mobility for older road users in the United States.

Improvements made to benefit this user group will result in safety and mobility benefits for the general population. Major issues of interest included the following:

- ▶ Safety planning and evaluation programs
- ▶ Policy approaches to improving infrastructure to better meet the needs and capabilities of older road users
- ▶ Transportation planning policy initiatives to address mobility of older citizens in terms of land use, transit, and other alternatives to driving
- ▶ Infrastructure-based international best practices that improve safety and mobility for older road users that could be applied in the near term on U.S. roadways
- ▶ Policy approaches to improving older driver assessment, licensing, and training
- ▶ Safety research collaboration opportunities between international and U.S. transportation research centers
- ▶ Ways to improve U.S. and international practices for long-term transportation planning for older road users.

To help the host countries address the team's concerns, a set of amplifying questions (see Appendix A) was provided to the hosts several months before the trip.

## Host Delegations

During the 2-week trip, the team members met with representatives from the various national and regional transportation agencies in the host countries. A complete list of agencies and topics addressed is in Appendix B.

## Travel Itinerary

During the 2-week trip, the team visited representatives in two countries: Australia and Japan. The team visited three states in Australia—New South Wales, Victoria, and Queensland—and the capital city—Tokyo—in Japan. The itinerary is listed below:

**MARCH 2: Sydney, New South Wales, Australia**—*team meeting*

**MARCH 3–4: Sydney, New South Wales, Australia**—*meetings with hosts*

**March 5–7: Melbourne, Victoria, Australia**—*meetings with hosts*

**MARCH 8:** *Travel day*

**MARCH 9: Brisbane, Queensland, Australia**—*team meeting*

**MARCH 10–11: Brisbane, Queensland, Australia**—*meetings with hosts*

**MARCH 12:** *Travel day*

**MARCH 13–14: Tokyo, Japan**—*meetings with hosts*

**MARCH 15: Tokyo, Japan**—*team meeting*

**MARCH 16:** *Return to United States*

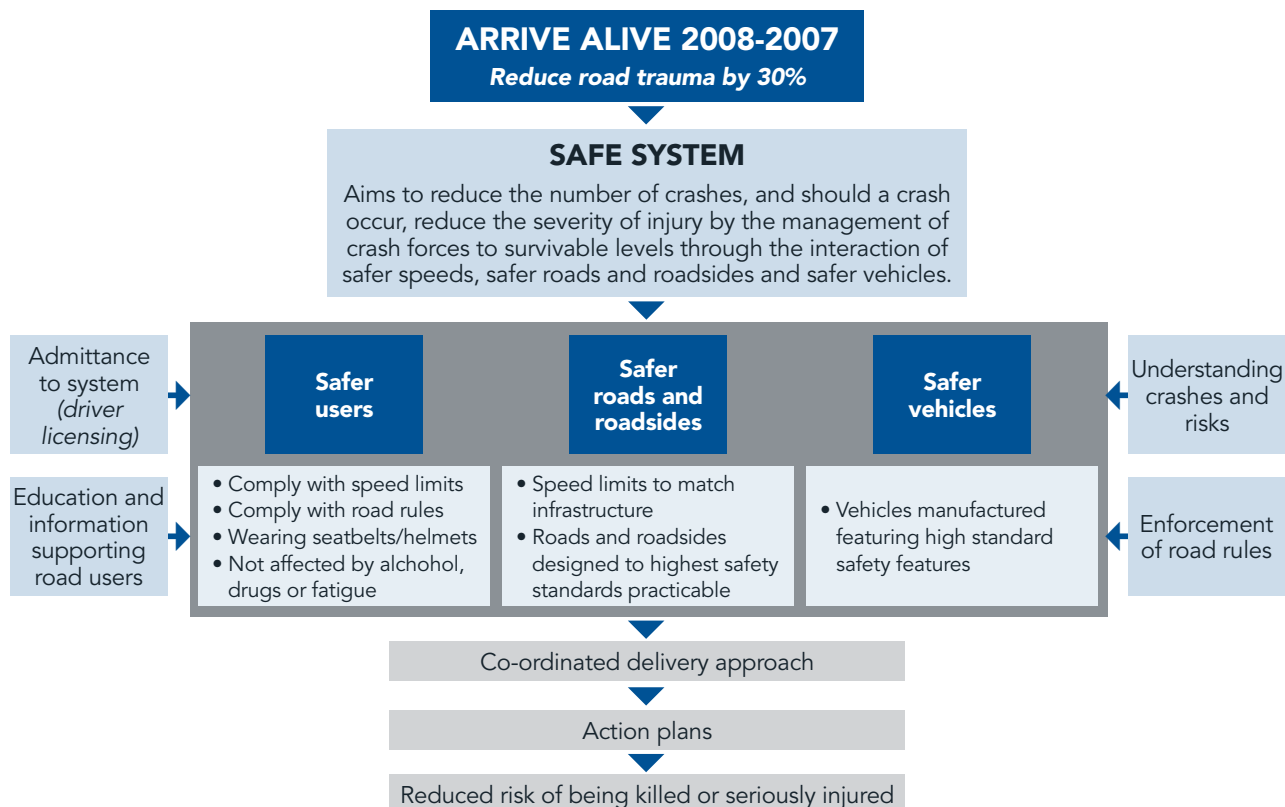


# A Systems Approach to Safety Benefits Older Road Users

A systems approach to safety involves users, roads and roadsides, and vehicles. This philosophy aims to improve safety by addressing each of these components of the transportation system. Figure 2 illustrates the systems approach adopted by VicRoads in Australia. This multiple-perspective approach has been successful because it reduces driver error through education, enforcement, and road design while at the same time reducing the health impacts of crashes when they do occur by improving vehicle safety and building more forgivable roadsides.

As mentioned earlier, the ages of road users in Australia and Japan are similar to those in the United States. Both countries focus on the frailty of older road users. Nearly all of the agencies visited had a general aim of keeping older people in vehicles as long as possible to prevent them from

moving to a much more vulnerable class of road user—pedestrian. This guiding principle could be viewed as being at odds with concerns about the risk older drivers pose to themselves and other road users of all ages because of diminishing perceptual, physical, and cognitive abilities. In many sessions, however, the scan team’s hosts presented the argument that the older road user’s risk of injury and death is much greater as a pedestrian than as the operator of or as a passenger in a vehicle. For this public health benefit, officials in Australia and Japan try to keep older people driving as long as they can safely do so. This attitude leads to programs to help drivers, their families, and medical professionals assess fitness to drive and policies that favor license limitations based on driving needs and ability before complete license revocation. A lack of transit alternatives and capacity will also cause people to stay in their cars longer.



**Figure 2.** Illustration of a systems approach to safety from VicRoads’ Arrive Alive!<sup>(19)</sup>



Another consequence of this focus on frailty is an emphasis on reducing crash severity, not just crash frequency. The performance metrics the Australian agencies use combine fatal and severe injury crashes into a single “road tolls” category. These agencies recognize that reducing severity includes making changes in vehicle and roadside safety, in addition to roadway design and operations. The focus of crash reduction is not just eliminating fatalities, but rather reducing the severity of all crashes. The main operational change used to reduce crash severity is lowering vehicle speeds. Reducing speed especially benefits older road users because of their frailty. Throughout Australia, the general focus was on speed reduction to improve outcomes for both vehicle-vehicle crashes and vehicle-pedestrian crashes. Both New South Wales and Victoria widely use automated speed enforcement (i.e., speed cameras) in an effort to curtail speed-related injuries (see figure 3). In addition to automated enforcement, legislatively mandated speed limits are imposed in areas with high pedestrian traffic. These include schools, shopping districts, and entertainment precincts (see figure 4). Reducing speeds also allows more time for older drivers and pedestrians to react to events. This is important for older road users because response times, on average, tend to increase with age.



**Figure 3.** Automated speed enforcement warning sign in Sydney, Australia.



**Figure 4.** Reduced speed zone in high-pedestrian traffic area in Brisbane, Australia. Similar speed zones exist in other Australian states for shopping districts and school zones.

A theme running through road safety programs in each Australian state was that addressing fragility involves more than focusing exclusively on driver and pedestrian behavior. The focus needs to be on vehicle and roadside safety as well. The rationale for this perspective is that since road users will continue to make errors, road safety programs should attempt to minimize the consequences of those errors. One way to minimize the consequences of driver error is to provide more forgiving roadsides by eliminating pavement edge dropoffs, providing flatter cross-slopes, and installing roadside safety devices such as guardrails. Roadside safety approaches such as these were observed in both countries the scan team visited.

On the vehicle safety side, one example of this systems approach is the current evaluation of vehicle crashworthiness standards in the state of Victoria and a consideration of test parameters specific to older occupant injury types. Other vehicle safety programs are aimed specifically at older drivers. Transportation agencies, as well as other community groups, have developed educational materials to explain optional vehicle safety equipment to a mature audience.

The systems approach allows agencies to address safety issues with a multidisciplinary approach. This allows



comparisons of the effectiveness of these different approaches. One opinion the team heard repeatedly in Australia was that engineering solutions hold more promise than education for improving safety. This tenet was expressed at every agency and university the team visited in Australia. Research at Queensland University of Technology showed that errors made by older drivers in at-fault crashes were errors in judgment, not errors of risk estimation as seen with younger drivers. For instance, older drivers are more likely to judge inaccurately the speed of oncoming vehicles while turning at intersections, leading to poor gap selections, while younger drivers are able to judge the speed accurately but take higher risk gaps because they believe they can make it through the intersection in time.<sup>(14)</sup> Engineering solutions to common errors of older road users include protected turn phases at signalized intersections and curbside fencing to route pedestrians to actuated midblock crosswalks. What these engineering treatments have in common is that they remove the go/no-go decision from the driver or pedestrian. The infrastructure tells the user when it is safe to proceed into a dangerous conflict point, such as an intersection.

Both countries used research, conducted in their own countries or abroad, to support their policy decisions. The research was often used to quantify the safety or mobility benefit of a program or policy. The implementing agencies then calculated the costs associated with the programs and used this benefit-cost ratio to set priorities and policy. All agencies visited also used the research as support against political or popular pressure to change policies and practices.

## Strategic Safety Plans

Initiatives for older road users must be viewed in the context of the agency's overall road safety plan. The Australian states the scan team visited, in particular, had clearly articulated strategic road safety plans. These plans were comprehensive and included measurable goals and evaluation plans. Each plan touched on issues specific to older road user safety, but recognized that overall road safety improvements would benefit all users. Figure 5 illustrates two of the documents pertaining to the strategic safety plans. A previous FHWA/AASHTO scanning study examined the state of Victoria's safety plan in detail.<sup>(15)</sup>

On a national level, the Australian Transport Council launched the National Road Safety Strategy 2001–2010 plan. The council is made up of member organizations, including state and federal government agencies, insurance companies, automobile clubs, and user groups.<sup>(16)</sup> The plan is implemented primarily by state and local governments. The goal of the plan is to reduce the fatality rate from 9.3 per 100,000 people in 1999 to 5.6 by 2010.

The department of transportation in the Australian state of New South Wales is the Roads and Traffic Authority (RTA). This agency oversees all roadway construction, maintenance, and operation for the state. In addition, this agency handles vehicle and driver licensing. The state government is implementing its Safer Roads Priority Development Plan, which called for the creation of a Centre for Road Safety in the RTA. The centre began operations in January 2008 and is founded on a safe systems partnership approach that includes programs to address safer roads, safer vehicles, safer people, and road safety technology.<sup>(17)</sup> Its Road Safety 2010 plan places an emphasis on reducing speeding and involving local governments in implementation.<sup>(18)</sup> The Centre for Road Safety, functioning in the state DOT, has signoff responsibilities for preliminary and detailed construction and operational change plans. This responsibility allows for the implementation of safety-conscious planning.

The state of Victoria's department of transportation, VicRoads, has a strategic safety plan called "Arrive Alive!" The first phase of this plan ran from 2002 to 2007, and it was recently revised and extended through 2017. The larger plan is implemented through 3-year action plan documents<sup>(19)</sup> that function as a systematic "black spot" (high crash location) reduction program. This action plan is also based on a safe systems approach that calls for programs aimed at roads, vehicles, and users. Safety improvements are implemented through revised design standards for roads and roadsides for construction and maintenance activities. The "gray spot" program takes information from the black spot crash analyses and applies these countermeasures to locations, particularly intersections, with similar characteristics. On this systemic level, road safety targets are established and evaluated through the use of a macro-level modeling tool.<sup>(20)</sup> This evidence-based approach, adjusting for future growth in exposure and vehicle ownership, predicts long-term traffic safety

improvements due to changes in the systematic variables of roadway infrastructure, speed, vehicle design, and driver behavior. In this way, the tool helps policymakers set realistic traffic safety goals and evaluate the impact of individual crash reduction measures.

The current 3-year VicRoads action plan calls for new actions in the areas of road improvements, vehicle safety standards, drugged driving enforcement, young driver graduated licensing, and strategic enforcement of speeding and impaired driving. The larger plan includes actions aimed at older drivers through education, infrastructure improvements, and research. The infrastructure improvements aimed at older road users include land-use planning and roadway design enhancements. These are discussed in detail later in this report.

The third Australian state the scan team visited, Queensland, also has a road safety strategy administered by its transportation department, known as Queensland Main Roads. The Safe4Life plan is similar to the other states' plans in its systematic approach. Because Queensland encompasses a large portion of rural roads in the outback area of Australia's interior, this plan includes more strategies aimed at rural road safety and heavy vehicle movements. One action item of this plan is the Safer Roads Sooner program, which allocates money for low-cost road safety improvements in high-crash locations. Examples of these improvements include

shoulder rumble strips, new traffic signals, and roadside hazard removal and shielding.

Japan also has stated road safety improvement goals for federal and state (prefecture) roadways. Its plan was developed with input from citizens in local communities who answered the question "What should the roads be like for the next 10 years?" It also invoked a sense of community and familial responsibility by asking citizens and officials "Is this the type of roadway system we want to leave for our children and grandchildren?" The goals were set during the Central Traffic Safety Measures Conference, chaired by the Japanese prime minister. The conference set a target to reduce traffic fatalities to below 5,000 by 2012. The roadway improvements of this plan primarily focus on high-crash locations. Systemwide programs focus on pedestrian and bicycle safety by removing utility poles in urban areas, separating pedestrians and bicycles from vehicular traffic, and improving accessibility of transportation systems for handicapped users. Public support for this program was garnered through use of an analogy in media reports that tied the number of road crash fatalities to the number of Japanese killed in the Sino-Japanese war during the Meiji period.

In the United States, federal legislation (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)) mandates each State to develop its own strategic highway safety plan. To date, 24 of 50 States



**Figure 5.** Examples of state strategic road safety plans in Australia.

have included items specifically geared toward improving older road user safety. Like Australia, each U.S. State has its own safety plan, but the States vary in their implementation progress.

## Strategic Partnering

In both countries visited, but particularly in Australia, road safety programs were delivered through partner organizations, not just by transportation agencies. In Australia, this approach is very much in keeping with the safe systems approach and brings a safety culture to the partnering organizations.

### *Local Governments*

National and state road safety initiatives in Australia are communicated and executed through partnerships with local councils, the equivalent of U.S. county and city governments. The scan team heard directly from one Melbourne suburb, the city of Whitehorse.<sup>(21)</sup> The road safety officer from this town worked directly with a traffic safety staff member from the district VicRoads office. Together, they developed a road safety strategy for the city that draws on the statewide program, but sets priorities based on the city's own crash data. The road safety programs include pedestrian safety training, vehicle safety checks, and senior driver seminars. In addition, the local government unit hires engineering consulting firms to conduct road safety audits. The programs are funded by a city tax. The program administrator reports that these programs reflect well on the city government and make citizens feel safer. Similar programs exist in New South Wales as part of its Road Safety 2010 strategic plan.<sup>(22)</sup> It is important to note that not all local councils have dedicated road safety resources to put toward a traffic safety staff member.

In addition to individual city road safety coordinators, the state DOT sponsors RoadSafe groups through its regional or district offices.<sup>(23)</sup> A VicRoads traffic safety staff person works with community groups across multiple councils that make up RoadSafe groups. The activities of these groups focus primarily on behavioral programs. They receive matching funds from VicRoads and local councils and/or private businesses to run their programs. For example, in one council a local taxi company sponsors safety programs and in return is allowed to list its phone



**Figure 6.** Logo for community RoadSafe program sponsored by VicRoads in Victoria, Australia.

number on provisional drivers' license plates, along with a message reminding provisional (novice) drivers of the zero-tolerance drunk driving laws.

Another partnering approach is taken in the Australian state of Queensland, where the Main Roads state DOT teams with the Local Government Association of Queensland (LGAQ) to address road safety problems.<sup>(24)</sup> These two entities jointly sponsor the Roads Alliance, which develops regional plans, coordinates resource sharing, and conducts road safety audits in coordination with the Australian Road Research Board (ARRB). The Roads Alliance board administers funds provided by the state government by diverting 20 percent of state funding directly to local administration. These safety activities are conducted on a regional network basis through the designation of Regional Roads of Significance. This designation assures a systematic approach to improvement protected from local political priorities. In addition, the Roads Alliance is pilot testing local government road safety program administrators, as used in other states. The LGAQ also provides local councils with road safety program information and support through its community toolbox program.<sup>(25)</sup>

In Japan, certain regional offices of the Ministry of Land, Infrastructure, Transport, and Tourism have developed their own traffic safety plans. The scan team attended a presentation of one such regional plan from the Kanto district, which includes the city of Tokyo. The Regional Development Bureau strives to use crash data to set



**Figure 7.** Local Government Association of Queensland Community-Based Transport Toolbox.

priorities for infrastructure improvements. It calls this plan Mieruka, which translates as “visualization,” to stress the importance of looking at data while identifying issues and setting priorities.

### **Motoring Clubs**

Another partnership witnessed in Australia is the link between state governments and motoring clubs. Each state has its own club that is part of the national Australia Automobile Association (AAA). These clubs provide road safety information, evaluation, and education to members. Perhaps more than in the United States, the Australian motoring clubs collaborate with government transportation agencies to shape public policy. The clubs offer a diversified range of services, such as tour packages and resorts, that appeal to members even if they no longer drive a vehicle. Motoring clubs also provide road safety and vehicle safety information to their customers.

The potential safety of roadway segments based on design elements is rated independently by the Australian Road Assessment Program (AusRAP), which is administered by the AAA with financing from state and federal governments and state motoring clubs.<sup>(26)</sup> AusRAP provides Star Ratings, similar to vehicle crashworthiness ratings, for state roads.<sup>(27)</sup> State motoring clubs, such as the National Roads and Motorists’ Association (NRMA), also provide reports

on community roads to local councils (city governments).

<sup>(28)</sup> The clubs also provide senior driver education and self-assessment programs detailed later in this report.

### **Health Service Providers, Insurance Companies, and Retirement Planners**

Health service providers and health insurers also were partners in road safety activities. Overall, Australian education efforts for older drivers emphasized physical fitness and how this affects ability to drive. The focus on physical fitness also has implications for pedestrians’ ability to climb on and off transit vehicles, to cross the street within timed walk phases, and to avoid slip-and-fall hazards throughout the roadway environment. The health-care providers’ main effort appeared to be to lessen the suddenness of the transition from driving to nondriving. Programs were in place to train home health-care workers to provide information about mobility options for people who had ceased driving because of age-related illnesses or decline. Transportation safety education programs were tailored specifically to older road users’ experience and judgment.

Victoria has a unique liability insurance program, whereby all injuries due to motor vehicle crashes are covered by a state-run Transport Accident Commission funded by vehicle registration fees. This gives the state unprecedented access to health-care outcomes and costs. These data are used to evaluate the success of the road safety plan.

The last example of an innovative partnership involved retirement planners and pension fund administrators, who are beginning to encourage their clients to include planning for transportation needs as part of normal retirement planning. Their thinking is that in discussions on goals for retirement activities, it would be natural to include transportation needs and options.



# Policy and Planning for Older Road User Safety

As described in the previous chapter, systematic safety planning is an important element of policy development. In both countries, it was clear that safety needs to be a consideration both at the highest levels of government and the local level. Federal and state legislative bodies discuss road safety and, specifically, older road user issues. Also, at the highest level of government officials, state premiers (governors) have roadway safety as important policy initiatives. The involvement of political officials is key to securing long-term funding and building societal support for road safety initiatives. In Australia, the long-term strategic road safety plans adopted by each state had champions in the federal parliament and relevant ministry offices. The policies developed permeated the entire the department of transportation, regardless of departmental organization. Across the three states visited, the scan team observed different organizational structures of the functional groups of transportation planning; operation, construction, and maintenance; risk management; and drivers' licensing and testing. The road safety goals and culture operated across agency and divisional boundaries.

Another important factor in the success of safety planning was the way long-term, aspirational goals were combined with short-term action plans. State safety plans typically covered a 5- to 10-year period, with ambitious crash reduction goals clearly stated. These plans were always accompanied by action plans, typically in a 1- to 3-year framework, that could be used to set funding and legislative priorities.

In Japan, as well, federal research and safety improvement plans were being applied by government entities at the prefecture (state) and city level. This focus on data-driven decisionmaking was dominant in all of the Japanese programs reviewed. This was true for national, regional, and local agencies. Historical crash data were used to garner political and popular support for infrastructure investment and safety program and policy development.

This integrated use of data from multiple sources to guide safety planning was prominent in both countries. Data

sources for plan development included the items listed below. Subsequent report sections present examples of how some of these data elements are used to guide strategic safety plan and policy development.

- ▶ Demographic projections, including immigration and geographic distribution in the city, state, or country
- ▶ Long-range land-use and development plans
- ▶ Historical crash data and projected estimates
- ▶ Roadway infrastructure inventory and asset management data
- ▶ Medical cost and crash outcome health data
- ▶ Vehicle damage data from private and public insurers
- ▶ Surveys of transport system users, citizens, and motoring club members
- ▶ Personal travel surveys and diaries

## Examples of Evidence-Based Planning and Policy Development for Older Road Users

### *Personal Travel Surveys*

One example from Australia of how planning tools directly guide policy is at VicRoads. The state of Victoria is conducting a large personal travel survey that will guide transportation planning through 2030. The Victorian Integrated Survey of Travel and Activity (VISTA) will provide data for land-use planning, transit services, and other programs. Results of the last large survey, conducted in 1999, showed that two-thirds of men over age 65 made their daily trips by driving. The policies and programs that arose from this finding are in four areas:

- ▶ Supporting older drivers to drive safely longer through education and vehicle and infrastructure improvements
- ▶ Supporting older drivers transitioning to nondriving through research on licensing tests and self-assessment educational programs
- ▶ Making conventional transport more user-friendly for older people by changing schedules and fares and by improving physical accessibility
- ▶ Removing barriers and providing incentives for innovative community transportation approaches, such as demand-response services and subsidized taxis



### ***Long-Range Land-Use and Development Plans***

Transit service planning can also be aided through data examination. The Roads Alliance, mentioned in the previous chapter, provides regional planning coordination and resource sharing and accelerates the achievement of safety goals. The coastal areas of Queensland are popular locations for large planned retirement communities, but they are located in rural and suburban areas that are not well served by transit. By examining land-use development plans, local agencies can work with developers to improve roadways serving these communities in ways that specifically aid older drivers. For instance, agencies may recommend protected turn phases at signalized intersections serving the development. To serve residents who have stopped driving, local transportation officials may recommend improved pedestrian access to transit stops in the development. The Community-Based Transport Toolbox<sup>(25)</sup> includes suggestions on establishing ride-sharing programs at congregate living facilities and retirement communities.

Transit use in Australia and Japan is complemented by government policies that support urban infill and concentrated development near transit stops and stations. The scan team was impressed by the number and variety of transportation options available and the general mix of residential, institutional, and light commercial development located along or near the arterial roadway network. Sidewalks and bicycle paths were typically included as part of the roadway design, and automobile parking restrictions and enforcement further supported their nonmotorized and public transportation investments. Throughout the Australian cities visited, the team noticed a significant number of outdoor public recreation and athletic facilities. Taken together, these policies and practices contribute to the development of walkable and livable communities and the opportunity for older road users to age in place. One such example of a transit-oriented development is in the Melbourne suburb of Box Hill.<sup>(29)</sup> The state of Victoria has invested in expanding tram and bus services in this area. Other communities also benefit from the state's Transit Cities program.<sup>(30)</sup>

### ***Local Government Safety Planning***

An example of how data are used as performance metrics was observed in Whitehorse, a Melbourne, Australia, suburb with a population of 143,000. There the city council funds a traffic safety staff position through city tax revenue.

This person develops a 2-year safety improvement plan based on analyses of local crash data, citizen input, and an evaluation of the effectiveness of past educational and infrastructure programs. This plan is presented to the council, which endorses it and provides funding that is administered by the traffic safety staff person. This action plan is tied closely to the state strategic plan.<sup>(31)</sup> One program in the strategy is the Wiser Driver behavioral education program for older drivers, which was developed by Hawthorn Community Education Centre in Victoria, Australia. The city traffic safety officer works as a partner with his or her counterpart in the district state department of transportation office to deliver an education program over 4 weeks to seniors that, apart from driver safety, focuses on planning for future mobility, training on ticketing systems for transit, encouraging women to drive more while their husband is still alive to maintain their skill level, training on map reading, and trip planning to avoid high-risk left-hand turns.

### ***Roadway Infrastructure Inventory***

Queensland Main Roads uses modeling software to predict safety based solely on roadway and roadside design features, without looking at actual historical crash rates. The NetRISK software provides a tool for local maintenance and engineering staff members to inventory their current roadways and assess factors that may be more likely to cause crashes.<sup>(32)</sup> Examples include shoulder width, condition of pavement markings, and horizontal alignment. Weights in the model can be modified to emphasize particular data elements to target specific user groups, such as older road users.

### ***Surveys of Transport System Users and Citizens***

In Japan, the scan team found an example of using citizen survey data to prioritize investment and programs. The Japanese federal transport agency recognizes that local and regional priorities vary based on land use, commuting patterns, and existing infrastructure. Because of the relatively late start in the construction of expressways in Japan in general, the main concern in the past in all prefectures was expressway construction. Today, however, an increasing number of local governments rate the importance of other infrastructure elements higher than expressways. These include taking disaster preparedness measures, burying utilities, and improving roadway accessibility for disabled and elderly users primarily

through sidewalk improvements and barrier removal. In the face of the diversified needs in the towns and prefectures, the federal agency wants to know if the performance measures it has developed are really sufficient to meet these needs. Federal laws and policy development are now based solely on crash data.

Logically, addressing the high-importance items identified by the citizen survey will affect crash rate. For instance, burying utility lines eliminates many casualties due to struck-object crashes. Likewise, improving sidewalk facilities will minimize vehicle-pedestrian conflicts and should reduce pedestrian crashes, a prominent problem for older road users. The aim is not just to improve safety, but also to improve the aesthetics and usability of the road scene. The Japanese Ministry of Land, Infrastructure, Transport, and Tourism is developing performance metrics that capture both the safety improvement due to these changes and the more intangible benefits to the roadscape and livability of the affected areas.



# Infrastructure Improvements for Older Road Users

## Standards and Guidelines

As in the United States, the consensus standards development process in Australia and Japan is time consuming. Best practices and established engineering solutions may appear in guideline documents years before they are incorporated into state or federal design standards. This implementation lag is present in the United States as well. The recommendations of the FHWA *Older Driver Highway Design Handbook* are just now appearing in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and *A Policy on Geometric Design of Highways and Streets* (AASHTO Green Book), even though the original handbook is more than a decade old.

Austrroads is the association of Australian and New Zealand road transport and traffic authorities, so it functions much like AASHTO does in the United States. Austrroads has sponsored research and policy development to identify infrastructure improvements for older road users.<sup>(33)</sup> This major research effort, titled *Environment and Design for Older Drivers*, was conducted by researchers at Monash University Accident Research Centre under the sponsorship of Austrroads. Stage one of the research, conducted in the late 1990s, used the FHWA *Older Driver Highway Design Handbook* as a guide to evaluate the state of Australasian roads (encompassing Australia and New Zealand).<sup>(34)</sup> This effort also included site visits to “black spots” with a higher-than-normal involvement of older drivers in accidents. The site visits concluded that intersection sight distance and gap acceptance were particular problems for older drivers. The second phase of this project, completed in 2004, includes a large roadway design handbook with points to consider when designing roads to accommodate older road users.<sup>(33)</sup> A training workshop was also developed and efforts are underway to incorporate these recommendations into Australasian road design standards. In general, it appears that Australia has followed the FHWA model very closely on handbook and training course development paired with changes in existing standards to better address the specific needs of older road users.

The Japanese Industrial Standards address some infrastructure elements such as roadway lighting and accessibility for disabled people. The roadway lighting standard has been influenced by research on the visibility of elderly pedestrians.<sup>(35)</sup> The accessibility standards, similar to Americans with Disabilities Act standards in the United States, also serve the needs of older road users by specifying curb heights, tactile markings, and sidewalk widths to aid older people with mobility limitations.

## Institutional Issues in Implementing Infrastructure Changes

### *Jurisdictional Funding Priorities*

As in the United States, the countries visited have a stratified level of government, each with its own spending priorities and political pressures. The Japanese example cited in Chapter 3 on local agencies’ desires for infrastructure changes that affect the aesthetics and livability of their towns demonstrates this.

In Australia, the strategic safety plan is used to unify all levels of government on project selection and funding. As mentioned in Chapter 2, the involvement of political officials from all levels of government in developing and adopting the strategic safety plan can prevent some of these conflicts. At a state government district office level, the national or state safety plan can be used as a defense against politicians and citizens who may be promoting infrastructure changes that will have a smaller impact on safety. In addition to the safety plan, crash data and projections can also be used to defend priorities.

Cost-sharing plans that give local governments direct control over a portion of state or federal aid money are another tool used to encourage improvements on local roads. The Japanese federal roads agency has used crash data to demonstrate safety problems on local roads to local governments. It then offers to improve regional arterial systems to pull traffic off the local roads, reducing traffic volumes and exposure on the local roads. This

traffic diversion enables local governments to establish lower speed limits in residential areas, enhancing pedestrian and bicycle safety.

Some local governments may be reluctant to participate with state or regional partnerships because they view roadway issues as state issues and fear that maintenance costs may shift to them. Good communication between local and state district officials is important to assuage those fears. Professional societies and formal partnerships such as the Road Alliance can also promote interaction and information sharing.

### **Regional Coordination and Partnerships**

Coordination of design and operations standards, maintenance activities, and construction on a regional level is important to provide road users with a predictable system. This predictability in and of itself can enhance safety by easing the driving task. Local preferences for certain infrastructure elements that provide a local identity such as street name sign design, crosswalk markings, or roadside landscaping can often interfere with the goal of uniformity. Formal partnerships such as the Road Alliance in Queensland offer one way of encouraging coordination and cooperation by providing a means for local agencies to share resources, such as sign maintenance contracts that save money for the agency but also provide uniformity on regional roadways.

### **Design Flexibility**

A flexible approach to roadway design standards, similar to the U.S. resurfacing, rehabilitation, and restoration (3R) standards, was discussed at Queensland Main Roads. This concept, known as the Extended Design Domain, allows roads to meet different minimum design criteria as long as there is no known negative safety record. This flexibility in design criteria allows rehabilitation improvements to be made without bringing the entire roadway up to current design standards. It also allows funds to be spread across multiple lower-cost improvements on a systemwide basis rather than dedicated solely to one expensive countermeasure. If the roadway serves areas of high use by older drivers, as determined by local authorities,

these extended design criteria cannot be applied and the road must meet the highest current standards.

The scan team observed other examples of flexibility in roadway design in many of the urban areas it visited. Innovative pedestrian treatments were applied in locations judged by local engineers to be areas of high pedestrian traffic. In other cases, countermeasures were installed based on crash history. Systemwide transit boarding area improvements were being phased in where right-of-way allowed. In some cases, traffic lane shifts and parking restriction changes were necessary to accommodate the wider boarding areas.

## **Implementation Examples**

The FHWA *Older Driver Highway Design Handbook*<sup>(13)</sup> and the subsequent Australian modification of it<sup>(12)</sup> were the basis for most of the roadway improvements observed in Australia. Many of the improvements implemented, particularly those at intersections, focus on removing the go/no-go decision from the driver.

### **Intersection Operations and Design**

For urban intersections, the most common improvement was to add a protected right-turn (left-turn in the United



**Figure 8.** Protected right-turn signals in dedicated right-turn lanes in Melbourne (equivalent to left turn in the United States).



States) phase and add a turn arrow to the signal head. This improves safety for all drivers, but especially for seniors, who have historically high crash rates in these situations. The addition of a dedicated turn lane also aids older drivers by removing them from through traffic. More important, it offsets them laterally to provide better visibility of oncoming traffic. As figure 8 shows, the signal head is mounted overhead and on the center median island to further enhance visibility.

Another area of infrastructure improvement aimed at older road users in Australia was roadway and roadside design criteria changes. Examples from geometric design were adjustments to intersection angle and merge lane length that would differentially aid older drivers by reducing the amount of head turning needed to navigate intersections and merge areas. For older drivers, a more perpendicular crossing also reduces the need for extreme head turns, which can be difficult for those with arthritic necks and shoulders.

The slowing response times of older drivers were reflected in allowing longer perception reaction times in formulas for intersection sight distance and stopping sight distance. Many of the adjustments to these parameters were adapted from the FHWA *Older Driver Highway Design Handbook*.<sup>(13)</sup>

### **Traffic Control Devices**

As with most other safety improvements, changes in traffic control device standards aid all drivers, not just older drivers. Traffic control device standards in Australia require high-brightness sign sheeting and pavement marking materials to ensure good nighttime visibility for older road users.<sup>(36)</sup> Some agencies use larger signs and wider markings to further this aim, but no standards are in place for these applications.

In Japan, horizontal curves on expressways are enhanced through the placement of retroreflective materials on concrete median barrier walls and guard rails, as figure 9 shows. The Japanese also make widespread use of text and symbols in pavement markings. The text used on expressways shown in figure Figure 9 lists a destination city name before a major interchange.



**Figure 9.** Median barrier treatments and pavement marking text in Tokyo.

### **Pedestrian Facilities**

Both countries presented further examples of infrastructure improvements aimed specifically at pedestrians. These changes would especially benefit older pedestrians because of their large over-representation in severe injury and fatal crashes involving a motor vehicle and a pedestrian.

In Japan, a strong theme driving many changes to infrastructure is the physical separation of pedestrians, bicyclists, and motor vehicles. This is accomplished through sidewalk widening, dedicated barrier-separated bicycle facilities, and pedestrian grade separation at large, busy, multilane intersections (either overpasses or tunnels). Figure 10 (see next page) shows the street-level entrance to an underground pedestrian tunnel under a busy urban intersection in Tokyo. Even where barrier-separated bicycle lanes cannot be built, traffic control devices encourage separate travelways for these modes (see figure 11 on the next page, in which the text in the foreground reads “stop” and the text within the lane lines reads “bicycle”). These separations provide an added measure of protection from vehicles for vulnerable road users. In addition, Japanese officials reported some injury-producing collisions between bicyclists and pedestrians. The separation of bicycle and pedestrian facilities will help reduce those risks as well.



**Figure 10.** Underground pedestrian walkway under a busy urban intersection in Tokyo.



**Figure 11.** A crosswalk in Tokyo with separate lanes for bicycles and pedestrians.

In Australia, pedestrians were also the focus of many infrastructure improvements. These improvements aid all pedestrians, not just older persons, by providing better visibility of the crosswalk to approaching vehicles. Figure 12 shows a raised crosswalk with curb extensions in Sydney. This design shortens the walking distance for pedestrians, reducing the time they are exposed to traffic. The curb extensions also bring the pedestrian closer to the travelway, making the waiting pedestrian more visible to approaching motorists. Figure 13 shows a shopping area that uses curbside fencing and landscaping to channelize pedestrians to the crosswalks. In addition to parking restrictions near crosswalks, the landscaping provides a mechanism to provide bump-outs that shorten the



**Figure 12.** Raised crosswalk with curb extensions in Sydney, Australia.



**Figure 13.** A pedestrian crossing with refuge islands and gates in Sydney, Australia.



walking distance at the crosswalk. The median island signs and marking also improve the conspicuity of the crosswalk to approaching vehicles. Another example of pedestrian fencing is shown in figure 14. Melbourne also uses actuated pedestrian signals at midblock crossings in areas of high pedestrian traffic.



**Figure 14.** Midblock pedestrian-actuated crossing with pedestrian fencing in Melbourne, Australia.



**Figure 15.** Tram-bus transfer station in Melbourne.

Some cities, such as Melbourne, are making improvements to transit infrastructure to enable easy boarding and transferring for elderly and disabled riders. The transfer station located in the median of a suburban arterial street shown in figure 15 allows tram riders to exit the tram at the end of the line and board local buses without crossing the street. In general, after discussions with experts in both countries, the scan team believed that the low level of paratransit services was comparable to those in the United States. This was particularly true in rural areas. Both Japan and Australia have laws equivalent to the Americans with Disabilities Act, but it appeared that these laws had not been in place as long as the U.S. law.

### *Colored Pavements*

In both countries, the scan team noticed the frequent use of colored pavements for a variety of purposes. Australia used red to prohibit normal vehicular traffic from bus and taxi lanes (see figures 16 and 18) and green to emphasize bicycle lanes in high-hazard areas (see figure 17). Japan was experimenting with colored pavement to mark high-hazard horizontal curves. Crash data from one location shows a large reduction in run-off-road crashes, particularly for large trucks. Japan was also experimenting with using colored pavement as a tool for positive guidance and



**Figure 16.** Red-colored pavement used to mark a bus queue-jump lane at a signalized intersection in Melbourne, Australia.



**Figure 17.** Green-colored pavement used to highlight a bicycle lane as it crosses an unsignalized intersection in Sydney, Australia.



**Figure 18.** Bus lane with red pavement on the Sydney Harbor Bridge.

lane assignment through complex intersections. In lane guidance applications, the colored pavements match the colors of route legs shown on accompanying diagrammatic signs. This could be particularly advantageous to older drivers, especially in decreasing decision time at information-rich locations. Australia reported some recent developments in materials with durable color and sufficient pavement friction to not pose a safety hazard to pedestrians and cyclists. While these materials appear to show promise, thorough evaluations of material durability and driver behavior have not been completed. This is an area for future research in the United States.



# Driving Reduction and Cessation Issues for Older Road Users

As in the United States, the issue of driving cessation is one federal and state governments in Australia struggle with to maintain a balance between public safety and individual mobility. The public perception is that older drivers are hazards to other road users and should be removed from driving. This perception is reinforced when high-profile older driver crashes receive significant media attention. Crash data, however, generally do not support this perception. In general, agencies do not want to remove drivers from their vehicles prematurely because it creates a travel mode shift to walking, which has a higher risk for injury, and because driving cessation has negative health consequences as former drivers become socially isolated. During the scan study, radically different approaches to the problem were observed.

## Licensing and Assessment

In New South Wales, the RTA mandates annual driver retesting beginning at age 85.<sup>(37)</sup> Beginning at age 80, an annual medical certification is required. This recent change to the policy has prompted a strong response from the community and motoring clubs.<sup>(38)</sup> The RTA also maintains an anonymous tip line for family members, law enforcement, and the general public to report unsafe drivers who may need to be retested.

In contrast, the state of Victoria has conducted research that shows no benefit of mass age-based driver retesting and cannot justify the cost of these tests.<sup>(39)</sup> It allows mail renewals every 3 years for those over age 75. Victoria does provide many self-assessment aids, offered by several agencies, that encourage drivers and families to be aware of potential age-related declines in driving ability. As part of the RoadSafe community road safety program (funded through VicRoads), Wisser Driver courses (developed by Hawthorn Community Education Centre) are offered in the community and supporting information is provided to health-care providers and family members.<sup>(40)</sup>

The state of Queensland is reevaluating its driver licensing policy and expects changes to come in the next version of

its strategic safety plan. It now has a mandatory self-reporting requirement for certain medical conditions and a medical evaluation system. Some older driver medical conditions such as eye disease and dementia are covered by this system. Drivers over 75 must have a medical evaluation every 2 years.<sup>(41)</sup>

In Japan, the law is scheduled to change in 2009 to require driver retesting at age 75. The Tokyo government announced a new incentive program to encourage drivers over 65 to voluntarily surrender their driving privileges. The program partners with local businesses to provide discounts to those who give up their licenses.<sup>(42)</sup>

## Training and Education

The scan team's conversations with researchers and transportation officials in Australia indicated that for the most part they believe older drivers limit their driving to low-risk situations as they age. Training programs and educational materials, therefore, are often geared toward helping drivers and their families assess their fitness to drive and providing information on high-risk driving situations. These training programs do not focus on driving skills, but rather on understanding risks and adapting driving exposure and behavior to mitigate those risks.

As seen in the strategic safety plans, partnerships are crucial in senior driver training and education. The automobile clubs play an important role. The Royal Automobile Club of Victoria offers a road safety program for seniors on safe driving, driving skill, and assessing fitness to drive.<sup>(43)</sup> The 1-hour Years Ahead program is offered at senior centers, community clubs, and retirement villages. The same program is offered by National Roads and Motorists' Association (NRMA) motoring clubs in New South Wales.<sup>(44)</sup> In addition, they offer information on choosing vehicles with advanced safety features that provide more protection to frail seniors in the event of a crash.<sup>(45)</sup> Some clubs offer refresher behind-the-wheel driver training with a professional driving instructor.<sup>(46)</sup> These sessions can serve as an objective



assessment of fitness to drive as well as preparation for mandatory age-based retesting. In addition, the clubs offer study materials for driver's reexamination.<sup>(47,48)</sup>

A pilot program in Queensland, being evaluated by the local university,<sup>(49)</sup> provides peer-to-peer education programs for those considering driving cessation. The classes include self-assessment of fitness to drive, as well as information on using the transit system and accessing home delivery services. Officials have found that peer education is particularly effective for these topics. The evaluation will assess quality of life and mental health outcomes for participants. The hope is that by learning about mobility options, participants will get out of their homes more often. These trips have been linked to positive mental health in previous studies.

A similar program, called Mobility Advisor,<sup>(50)</sup> is being tested in Victoria in cooperation with the Monash University Accident Research Centre. The state Parliamentary Road Safety Committee initiated the program after public hearings and research on older road user safety.<sup>(51)</sup> The project will specially train state home health-care workers on mobility advice such as transit use. The project will measure performance by assessing physical and mental health and travel patterns throughout the study. It does not feature the peer education component of the Queensland program.

VicRoads provides a one-stop Web site for advice on transportation options after driving cessation for former drivers and their family members.<sup>(52)</sup> It provides information on driving cessation decisionmaking, public transport, and links to community alternative transportation programs. This Web site, along with several of the presentations the scan team saw throughout Australia, also promotes the use of delivery services for groceries, bill paying, postal services, and other common trip generators for older people.

Motoring clubs also offer members support for mobility after driving cessation.<sup>(53)</sup> While that may seem ironic, club officials report that these services help retain members who may use other travel and insurance products the club offers. In addition, the motoring clubs believe they have a role to play in representing not just the motoring interests of drivers, but also the mobility

interests of citizens in general, including nondrivers. The clubs believe that community prosperity and well-being depend on having efficient transport and mobility services in place.

## Community-Based Mobility Options

If drivers elect to stop driving, their transportation needs must be met by other means. Traveling in personal vehicles remains the dominant form of transportation for many elderly people who have stopped driving. This is accomplished through direct requests of family or friends and through community rideshare groups. Being dependent on others for rides can be stressful for older people. Research in Japan has shown that it is more stressful for the elderly person making the request than it is for the person being asked.<sup>(54)</sup> In the countries visited, as in the United States, there is a shortage of mobility options to serve all the trip needs of older citizens. This is particularly true in rural areas, where routine trips such as medical appointments or shopping can require traveling long distances.

The scan team observed a community-based program in Queensland offered by the Transport Development and Solution Alliance, a nonprofit organization that provides support to communities to develop and coordinate transportation services.<sup>(55)</sup> The representative from this group noted that the majority of trips are for medical care. With the growth in outpatient surgery, the number of trips is increasing as more follow-up appointments are required. These multiple trips often use up an individual's transportation budget for the month. The alliance sponsors a biannual conference among local governments, including those in rural areas, to share ideas for alternative transportation. The alliance has found that the cost of owning and maintaining a vehicle limits the success of many community-based programs. Some innovative vehicle use programs that have been tried in rural Queensland include the use of school buses for midday trips, the use of church buses during weekdays, and even the use of the local hearse as a transport vehicle for intercity trips in rural areas.

# Future Trends and Research Initiatives

## Future Trends

### *Societal Change Toward Aging in Place*

As life spans and health-care costs increase, Australia, Japan, the United States, and other countries are increasing the emphasis on aging in place. This means providing goods and services to individuals in their own homes as long as possible. This trend away from traditional old-age homes has several implications for transportation. One not-so-obvious effect is an increase in delivery services for such items as groceries and medicines. Indeed, some transportation counseling programs for older persons that the scan team learned about in Australia include training on how to obtain delivery of items to reduce the need to drive or use on-demand transit services.

The other, more obvious, effect of aging in place is the sustained emphasis on personal vehicles as the primary mode of transport for elderly people—either as drivers or passengers. Hand in hand with this is a growing need for transit services accessible to older road users. Housing development trends toward transit-centered, mixed-use residential and commercial areas will serve some access needs as older people move out of the traditional single-family suburban home. But even those who choose to stay in their own homes will need transit, most likely in the form of on-demand services.

### *Transport Mode Changes: Mobility Scooters, Motorcycles, and Recreational Vehicles*

Officials in both countries discussed the rising number of older people who use mobility scooters for transportation, often operating them in vehicle travelways. There was no clear consensus on what should be done in terms of licensing, training, or enforcement. Infrastructure changes may be needed to accommodate these machines as well. Some agencies provide public education materials to guide the selection of scooters and offer tips for safe operation.<sup>(56)</sup> In Japan, mobility scooters are welcomed by some in the aged services community who view them as a promising alternative form of transportation. They allow individuals to retain personal mobility, which is important for mental health and high quality of life.

In Australia, as in the United States, the number of older motorcyclists is rising. The largest single motorcycle club in Australia is the Ulysses Club, which is open only to members over age 50. Many of these motorcyclists are new riders or have not ridden in many years. Motorcycles today are much more powerful than 25 years ago, and a new “old” rider may not be ready for the new machines. Some agencies are considering changes in training and licensing laws to accommodate these returning motorcyclists, who may have kept their license current for 30 years but have not owned a motorcycle for many years. Again, the fragility and physical strength limitations of older motorcyclists pose a particular risk for injury.

The last trend on the horizon in Australia is an increase in recreational vehicle ownership among older people—the so-called “graying nomads.” As in the United States, retiring baby boomers are buying motor homes and camping trailers and going on extended driving trips. In Australia these trips pose a particular hazard because of the poor-quality roads in much of the country’s interior. In addition, these remote roads are used by long-haul tractor-trailers



**Figure 19.** An elderly shopper using a mobility scooter in Tokyo, Japan.

that tow up to four trailers (called “road trains”). Changes to paved surface widths, turn radii, passing lane length, and other infrastructure elements may be needed to accommodate this increase.

## Research Initiatives

Several research programs presented to the scan team hold promise for future policy changes, infrastructure development, and educational programs.

A study at Monash University Accident Research Centre (MUARC) uses a portable driving simulator located in a car dealership (see figure 20). This is a large-scale study examining driving patterns at intersections and other high-risk traffic maneuvers and hazards in drivers of all ages. In similar previous studies, MUARC researchers have shown that older drivers have a wider gaze pattern when negotiating some hazardous events, which in general is safer. But researchers also found that older drivers are



**Figure 20.** Scan team members test the Monash University Accident Research Centre driving simulator.



**Figure 21.** Example of a road train heavy vehicle used in rural Australia.

slower to notice a hazard such as an unexpected vehicle entering their lane. This delay is likely because of both slowed response time and the wider gaze pattern, which lessens the probability of looking in the critical location at the time the vehicle pulls out.<sup>(57,58)</sup>

MUARC is also conducting an Older Driver Naturalistic Driving Study similar to those proposed in the U.S. Strategic Highway Research Program (SHRP2) Safety program. This study will focus on older driver behavior at intersections. The study, funded by a private automotive company, will provide participants with an instrumented vehicle to drive for one month. Driving performance data such as gaze pattern, speed, braking, and steering will be collected for predetermined intersections in the Melbourne area.

The Queensland University of Technology is investigating the effects of age-related eye disease on driving through research using open-road driving with professional driving instructors and occupational therapists conducting assessments of older drivers on directed and nondirected routes. The professional instructors score drivers for errors in checking blindspot, lane position, gap selection, braking, and acceleration. The participants also undergo a battery of tests that measure vision, perceptual-motor skills, and physical health. The results of this test will be used to develop a battery of fitness-to-drive tests for use by medical personnel and licensing examiners. More basic research on the visual capabilities of older people who suffer from age-related cataracts and other eye diseases is also underway at this university. Another line of research here is examining pedestrian visibility enhancements provided by reflectors placed on biomotion points such as major joints (see reference 59 for a demonstration).

Researchers at the Center for Accident Research and Road Safety–Queensland (CARRS-Q) at the Queensland University of Technology are beginning an evaluation of older drivers of recreational vehicles, whom they refer to as “graying nomads.” This study will examine infrastructure changes needed to accommodate motor homes in rural and recreational areas. The study will also interview older RVers about safety concerns associated with driving in the outback, which is characterized by narrow roads, limited services, and heavy truck traffic (see figure 21 and endnote 60). Other research at CARRS-Q is examining the impact of multiple prescription medications on driving performance.



# Major Findings and Implementation Plan

## Findings

- ▶ The aging of society is a global issue and other countries face the same challenges as the United States.
- ▶ A systems approach to safety provides for integration of safety of older road users. Care must be taken with safety planning to keep the focus on a systematic approach, and not allow subgroups of users, such as seniors, to become individual categories addressed separately from the whole.
- ▶ Improving safety for older road users improves safety for all and vice versa.
- ▶ Removing driving privileges from older drivers prematurely has unintended consequences because older persons are at higher risk of injury as pedestrians than they are as vehicle occupants (drivers or passengers). The social isolation that often follows driving cessation impacts physical and mental health.
- ▶ Successful safety and mobility programs are being implemented at the local government level. These programs rely on data for program prioritization and evaluation.
- ▶ Research and practice have demonstrated engineering, policy, and educational programs that can improve the safety and mobility of older road users. These changes require the political will to provide the resources needed to implement them.
- ▶ Historical data can be a powerful tool in setting policy and priorities for engineering, operational, and educational changes to improve road safety for all users. Evidence-based planning and evaluation are also critical to gaining political support and countering public misperceptions about older road users' capabilities.
- ▶ Society must provide mobility options for older citizens to maintain their quality of life and their contribution to the economy.

## Implementation Plan

The scan team firmly believes that much can be gained in the United States by implementing the systems approach to safety and promoting the types of innovative partnerships it observed in the countries visited. To that end, the scan team plans a number of technical presentations and

papers at national meetings and conferences sponsored by FHWA, AASHTO, and other organizations to disseminate information from the scan. The team also formed a subgroup to draft a scan implementation plan for the initiatives and strategies described above.

The success of this international scan can be measured by the number of ideas brought back to the United States and translated into strategies that will improve safety and mobility for older road users. Below are the initial strategies that the scan team developed from the knowledge it acquired on this scan and that it believes are the most critical for making progress in the United States. These strategies, while aimed at older persons, will improve safety for all road users.

### *Enhancement of U.S. Roadway Design and Operations Practice*

The first implementation item is to integrate the knowledge of infrastructure improvements from Australia and Japan into relevant U.S. documents (e.g., FHWA's *Highway Design Handbook for Older Drivers and Pedestrians*) and training programs. FHWA is updating the handbook, and a revised version is expected in spring 2009. The implementation plan calls for a subsequent updating of the training curriculum and the development of a 1-hour briefing for DOT executives. The effort on this implementation item will include consideration of how state strategic highway safety plans could include infrastructure changes that would especially benefit older road users, as suggested in the FHWA handbook.

### *Outreach to Nontraditional Partners*

The second implementation item is to encourage partnerships between government agencies, such as departments of transportation and health, and nongovernment organizations (e.g., American Association of Retired Persons, American Automobile Association, National Optometric Association) to address the needs of older road users. Joint activities may include driver training and self-assessment programs, visual screening, pairing of transport planning with retirement planning, and development of educational materials on a variety of mobility topics.

### ***Targeted Research Program***

The scan implementation team has also created a plan to develop a research program on policies and interventions targeted at older road users. The program will cover evaluation of specific interventions aimed at improving safety and mobility for older road users, development of new procedures and tools to aid practitioners in making decisions, and sharing of information on best practices through synthesis documents and professional conferences.

### ***Establishment of Development Guidelines***

The fourth implementation item is to develop planning and land development guidelines for congregate housing and related transportation facilities and services intended to meet the growing needs of older populations and older road users. The guidelines would be developed to assist local governments and the development community in planning and retrofitting existing facilities, as well as to help local governments evaluate land development proposals as they relate to older populations and older road users. The proposal could become a joint-venture research project developed cooperatively by national transportation and land development organizations.

### ***Professional Training for Transportation Providers***

The last implementation idea arose from presentations on research that showed that one barrier to using transit was older users' fear of falling because of sudden starts and stops. The implementation team will evaluate the need for new training materials for professionals who provide alternative means of transport (e.g., transit, taxis, etc.) to educate them on the needs and capabilities of the elderly. To implement this training, the team will work with government and industry partners (e.g., Federal Transit Administration and American Public Transportation Association) to disseminate these materials throughout the profession. The team is aware of some existing training and educational materials and will assess how agencies have used them.



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# Amplifying Questions

The focus of this scan is on the implementation of infrastructure improvements and traffic operations for older road users. The scan team also aims to investigate and discuss policy initiatives on transportation system planning, operations, and design as they relate to older road users. Rural roadway safety issues are of particular interest to the group. The scope of this project specifically excludes driver licensing and remedial training programs, but the scan team is interested in learning about any particularly innovative programs in these areas in the countries it visits. The team is particularly interested in actually visiting roadways where infrastructure improvements have been implemented to observe firsthand the materials and construction techniques employed.

## Policy and Planning

### *Policy Development*

- ▶ What is the long-range vision or strategy of your agency to address older road users? What policies and programs are in place to address the needs of older road users?
- ▶ Are there specific laws, rules, and regulations in effect that require your agency to address the needs of older road users? Do you have flexibility in assessing these needs or has the policy been dictated from above?
- ▶ What efforts have you made to educate and influence decisionmakers and legislators about older road user issues?
- ▶ Are there partnerships established and used to address the immediate and long-term needs of older road users? Who are the partners (e.g., regional or local transportation departments, other government agencies such as licensing administrators, retirement organizations, medical professionals, automobile clubs, etc.) and how do they work together?
- ▶ What institutional barriers had to be overcome to allow infrastructure decisions to be made on the basis of safety benefits for older road users? How were those barriers addressed? Do they still exist?

### *Planning Data and Process*

- ▶ What is the demographic future of your country or region

and how will it impact the ability of the older population to use the transportation system (as drivers, pedestrians, and transit users)? What data sources are used for planning for older road users?

- ▶ What funding opportunities and constraints are placed on your agency to address the needs of older road users?
- ▶ Are there dedicated funds (e.g., safety programs, transit infrastructure) to address the needs of older road users? Approximately how much of the transportation budget in your country is spent on addressing older road user needs?

### *Mobility Alternatives and Community-Based Planning*

- ▶ How has transit-oriented development been promoted and implemented to accommodate older road users and minimize their automobile use or dependence?
- ▶ How are suburban and rural areas (where public transportation systems are not sufficiently robust) identifying needs and implementing alternative transportation programs for older road users?
- ▶ How do the transport sector and the health and human services sector coordinate policies and work together to meet older adults' transportation needs?

### *Implementation and Evaluation*

- ▶ How do you educate and train practitioners responsible for the planning, design, and construction of the infrastructure about the needs of the aging population and potential solutions to accommodate those needs?
- ▶ How do you assess the effectiveness of planning and policy initiatives targeted to older road users?
- ▶ How do you encourage innovation in traffic safety product development in the private sector in a way that rewards research that finds new ways to benefit older road users?

## Infrastructure Issues

### *Standards and Guidance for Engineering and Operations*

- ▶ Have specific standards and policies been developed that must be followed in constructing new facilities or



reconstructing existing facilities that specifically address the needs of older road users? Examples may range from typeface requirements on signs to changes in signal phasing to enhanced geometric designs.

- ▶ How are the needs of older users considered in the normal cycle of revising infrastructure design and operational standards?
- ▶ Have the needs of older road users changed the replacement cycle of critical infrastructure elements (i.e., signs, pavement markings)? How was this change justified?

### **Implementation and Evaluation**

- ▶ At what levels of government are engineering standards implemented—national, regional, or local? What policies and regulations are in place to insure the needs of older road users are met at all levels?
- ▶ How do you prioritize projects for implementation? What are the tradeoffs you must consider in implementation? Are the infrastructure improvement decisions most often made at the project level to respond to a specific problem or need, or at the system level to proactively address anticipated needs?
- ▶ What measures of effectiveness does your agency use to assess infrastructure or operational improvements?

### **Best Practices in Infrastructure Improvements**

- ▶ Can you provide case studies (examples) of successful changes in the following areas on improvements made for older road users: a) roadway design/geometrics (including intersections), b) traffic control devices (signs, signals, markings), c) pedestrians and bicyclists, and d) transit services/design?
- ▶ Have any of your advanced traveler information systems or other intelligent transportation system services been designed, tested, or implemented specifically with older users in mind?
- ▶ What specific facilities could you show our group that demonstrate infrastructure improvements designed to aid older road users?

## **Research and Evaluation Issues**

### **Research**

- ▶ What are the most significant gaps in knowledge that need to be addressed through research to improve facilities for older road users?

- ▶ What research is being pursued, either by your own staff or through agreements with research centers and universities, to identify potential infrastructure improvements to aid older road users?
- ▶ Who has taken the lead in identifying and funding research to address older road user needs? Are there partnerships in place to address these research needs?
- ▶ How do you integrate research results in your planning process and in the development of engineering standards and guidance?
- ▶ What are the safety research collaboration opportunities between international and U.S. transportation research centers?

## **Other Topics of Interest**

- ▶ Does your country or state have a special license renewal schedule for the older road user? Does special testing accompany license renewal after a certain age?
- ▶ How do you communicate the availability of other travel modes to older users to eventually have them rely less on the automobile?
- ▶ What programs are in place to educate older road users (as well as others) on the rules of the road and appropriate driving and walking behaviors, particularly where unfamiliar infrastructure treatments may be implemented? Are future initiatives planned to educate older road users?
- ▶ Are you helping to manage the transition from older driver to older passenger/traveler? What efforts are you engaged in that encourage older drivers who are not competent to drive to surrender their licenses? Do you have a program that targets the children of older drivers to help the parents make the decision to stop driving?
- ▶ Have you specifically accounted for older users when designing advanced traveler information systems and services (e.g., traffic Web sites, automated phone traveler information systems)?
- ▶ Are you aware of any innovative technologies being developed in your country that may assist older road users? This would include vehicle-based systems, as well as roadway or information systems.

# Itinerary and Meeting Schedule

DATE	CITY	MEETING TOPIC/AGENCY
<b>Sunday, March 2</b>	Sydney	Team Organization Meeting
<b>Monday, March 3</b>	Sydney	Road and Traffic Authority, New South Wales <ul style="list-style-type: none"> <li>• Centre for Road Safety</li> <li>• Traffic Management</li> <li>• Policies and Guidelines</li> <li>• Customer Education</li> </ul> Austroads <ul style="list-style-type: none"> <li>• Operations and Strategic Priorities</li> </ul>
<b>Tuesday, March 4</b>	Sydney	National Roads and Motorists' Association
<b>Wednesday, March 5</b>	Melbourne	VicRoads, State of Victoria <ul style="list-style-type: none"> <li>• Road Safety and Network Access</li> <li>• Road User Safety</li> <li>• Behavioral and Community Programs</li> <li>• Road Engineering and Safety</li> <li>• Vehicle Management and Safety</li> </ul> City of Whitehorse Road Safety Coordinator
<b>Thursday, March 6</b>	Melbourne	Monash University Accident Research Centre <ul style="list-style-type: none"> <li>• Epidemiology</li> <li>• Highway Design</li> <li>• Visual Impairments</li> <li>• Vehicle Safety</li> <li>• Cognitive Impairments</li> </ul> Tour of VicRoads Transit and Roadway Improvements
<b>Friday, March 7</b>	Melbourne	VicRoads, State of Victoria <ul style="list-style-type: none"> <li>• Infrastructure Policy</li> <li>• Network and Asset Planning</li> </ul> Organisation for Economic Cooperation and Development Activities on Older Drivers Transportation Accident Commission Royal Automobile Club of Victoria
<b>Saturday, March 8</b>	Travel Day	Melbourne to Brisbane
<b>Sunday, March 9</b>	Brisbane	Team Working Meeting

*continued on next page*

DATE	CITY	MEETING TOPIC/AGENCY
<b>Monday, March 10</b>	Brisbane	Queensland Department of Main Roads <ul style="list-style-type: none"> <li>• Road Design Standards</li> <li>• Design Innovations and Standards</li> <li>• Road Safety Strategy</li> <li>• Licensing and Standards</li> <li>• Local Government Relations</li> </ul> Local Government Association of Queensland Royal Automobile Club of Queensland University of Queensland Mobility Training Research
<b>Tuesday, March 11</b>	Brisbane	Queensland University of Technology <ul style="list-style-type: none"> <li>• Centre for Accident Research and Road Safety</li> <li>• School of Optometry and Institute of Health and Biomedical Innovations</li> <li>• Mt. Cotton Driver Training Centre</li> </ul>
<b>Wednesday, March 12</b>	Travel Day	Australia to Japan
<b>Thursday, March 13</b>	Tokyo	Ministry of Land and Infrastructure, Transport, and Tourism <ul style="list-style-type: none"> <li>• National Road Bureau</li> <li>• Kanto Division</li> <li>• National Institute for Land and Infrastructure Management</li> </ul> Expressway Authority Institute for Traffic Accident Research and Data Analysis
<b>Friday, March 14</b>	Tokyo	Iwate Prefectural University Tour of Tokyo Pedestrian and Transit Facilities
<b>Saturday, March 15</b>	Tokyo	Team Working Meeting
<b>Sunday, March 16</b>	Travel Day	Japan to United States



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## Biographic Sketches

**Elizabeth Alicandri** (*FHWA cochair*) is the director of the Federal Highway Administration's (FHWA) Office of Safety Programs. She provides national leadership to a wide range of highway safety initiatives, including the Highway Safety Improvement Program and the Safe Routes to School Program. She leads a multidisciplinary staff that supports States in developing and implementing strategic highway safety plans, improving data systems and analysis techniques, and advancing and applying tools to improve highway safety decisionmaking. Before joining the Office of Safety in 2000, she spent 15 years in the FHWA Human Factors Laboratory, managing an interdisciplinary staff and leading the development of the FHWA *Older Driver Highway Design Handbook* and the affiliated 1-day workshop that has been taught across North America. She has a bachelor's degree in psychology from Georgetown University in Washington, DC, and a master's degree in transportation engineering from the University of Maryland in College Park, MD. She is a member of the Institute of Transportation Engineers, serves on several committees of the Transportation Research Board, and is the secretary of the World Road Association (PIARC) Road Safety Committee.

**Pamela Hutton** (*AASHTO cochair*) is the governor's highway safety representative for Colorado, as well as the chief engineer for the Colorado Department of Transportation (CDOT). Hutton has 30 years of progressive engineering experience in the transportation industry, primarily with CDOT, where she started her career in the Safety and Traffic Engineering Branch. She has also held positions as region traffic engineer and statewide intelligent transportation engineer, during which traffic safety was a strong focus area for her. She has bachelor's and master's degrees in civil engineering from the University of Colorado in Denver, and is a licensed professional engineer in Colorado. Hutton is a delegate in a number of professional organizations, including the American Association of State Highway Transportation Officials (AASHTO), Western Association of State Highway Officials, and Governor's Highway Safety Association. She is a member of the AASHTO Standing Committee on Highways, which includes the Subcommittee on Highway Traffic Safety.

**Dr. Susan Chrysler** (*report facilitator*) is a senior research scientist in the Center for Transportation Safety and the manager of the Human Factors Program at the Texas Transportation Institute (TTI). Her areas of expertise include human factors, driver behavior, older driver issues, visual attention, traffic control devices, and photometry. Since joining TTI in 2001, Chrysler has led projects on sign and pavement marking design, comprehension, and visibility. Before joining TTI, Chrysler was a human factors specialist in the Traffic Control Materials Division Laboratory of the 3M Company. Her work at 3M involved developing products, conducting original visibility research, and developing marketing tools. Chrysler received a Ph.D. in experimental psychology with a minor in cognitive science from the University of Minnesota in 1993, and a bachelor's degree in psychology from the University of Minnesota. Chrysler is a member of several Transportation Research Board committees and is the past chair of the Surface Transportation Technical Group of the Human Factors and Ergonomics Society. She also chairs Human Factors Resources, a sponsor group for the National Committee on Uniform Traffic Control Devices.

**Dr. Leanna Depue** is the director of the Highway Safety Division of the Missouri Department of Transportation. She oversees the development and implementation of the State's strategic highway safety plan, "Missouri's Blueprint for Safer Roadways." This comprehensive safety plan addresses an array of highway safety initiatives in the engineering, education, enforcement, and emergency medical services areas. Currently 13.5 percent of Missouri's population is age 65 or older, a percentage that is expected to grow substantially. As a result, several older driver programs are being implemented throughout the State. Depue graduated from Southern Illinois University at Carbondale with a master's degree and Ph.D. in health education, specializing in safety. She serves on the Strategic Highway Research Program (SHRP2) Safety Technical Coordinating Committee, chairs the Safety Users Group for the Transportation Research Board, is vice chair of the AASHTO Safety Subcommittee on Safety Management, and is a member of the Highway Safety Manual Task Force. She also serves on the National Safety Council board of delegates and as regional director of the National Association of Women Highway Safety Leaders, Inc.



**Howard Glassman** is the executive director of the Florida Metropolitan Planning Organization Advisory Council, a statewide organization representing Florida's 26 metropolitan planning organizations. He is responsible for developing transportation policy and implementing strategies that support the movement of people and goods in Florida's metropolitan areas. The participation of older road and transit users in planning and providing modal choices is an important component of the transportation planning process. He serves on the Policy Committee of the Association of Metropolitan Planning Organizations in Washington, DC, and on the Metropolitan Policy, Planning, and Processes Committee of the Transportation Research Board. He was previously employed by the Florida Departments of Transportation and Community Affairs, the Mid South Engineering Company, and the Broward County, FL, Planning Department. He has a master's degree in community planning and area development from the University of Rhode Island and a master's degree in Urban Studies from Southern Connecticut State University. He has served as an adjunct instructor in urban and regional planning at Florida State University.

**Dr. Thomas M. Granda** is a senior research psychologist for the Office of Safety Research and Development at FHWA's Turner-Fairbank Highway Research Center in McLean, VA. He is the leader of the Human Centered Systems Team, which conducts behavioral research in such areas as intersections, visibility, pedestrians, speed management, signage, and pavement markings. In all areas of research, the performance of older road users (e.g., drivers and pedestrians) is always measured and analyzed. Granda has a bachelor's degree in psychology from Wagner College, a master's degree in general-experimental psychology from California State University, and a Ph.D. in human factors from the Catholic University of America. He is a member of the National Older Driver Safety Advisory Council and has chaired the U.S. Department of Transportation Human Factors Coordinating Committee.

**David L. Harkey** is the director of the University of North Carolina Highway Safety Research Center (HSRC). His research focus is on applying transportation engineering principles and research evaluation methodologies to improve highway safety for motorists, pedestrians, and bicyclists in the areas of traffic operations, geometric

design, and roadside design. He is a coauthor of the *Highway Design Handbook for Older Drivers and Pedestrians*, published by FHWA. He has conducted more than 20 workshops throughout the United States to teach engineers and planners about the guide and help them understand what changes can be made in the roadway environment to enhance older driver and pedestrian safety and mobility. Harkey has more than 20 years of experience in the field of transportation safety research, including the past 14 with HSRC. He is a graduate of the University of North Carolina at Charlotte with a bachelor's degree in civil engineering and a master's degree in engineering. Harkey is a registered professional engineer in North Carolina and chairs the Transportation Research Board Committee on Safety Data, Analysis, and Evaluation.

**Tom Smith** is the division administrator for the FHWA West Virginia Division in Charleston, WV. Smith and his team work closely with the West Virginia Department of Transportation (WVDOT) to deliver the Federal-Aid Highway Program, totaling almost half a billion dollars per year. West Virginia road users are among the oldest in the United States on a per capita basis, so FHWA's and WVDOT's delivery of the Federal-Aid Program is strategically designed to address these needs. Smith has served in a number of progressively responsible positions throughout the United States, including several management assignments in the design and construction of highways. He also served as the FHWA safety engineer in Ohio for 4 years. Smith received a bachelor's degree from North Carolina State University and completed a number of graduate courses at the University of California, Berkeley. He is a registered professional engineer in West Virginia, Ohio, and Pennsylvania, and has received a number of awards for leadership and achievements during his 29-year career with FHWA.

**Barry Warhoftig** is the director of traffic engineering for the West Virginia Division of Highways (WVDOH) in Charleston, WV. He is responsible for establishing, administering, and implementing policies, guidelines, and standards associated with traffic engineering activities throughout West Virginia. During Warhoftig's 40-plus-year career with WVDOH, he has had positions in the planning, design, implementation, operation, and maintenance of programs on highway signing, traffic signal control systems, and pavement markings. He has

also had a wide range of responsibilities associated with highway safety and bicycle-pedestrian initiatives. He has a bachelor's degree in civil engineering from Clarkson University in Potsdam, NY, and a master's degree in transportation engineering from Marshall University in Huntington, WV. He is a licensed professional engineer in West Virginia. Warhoftig serves on the AASHTO Standing Committee on Highway Traffic Safety, AASHTO Subcommittee on Traffic Engineering, and National Committee on Uniform Traffic Control Devices.





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