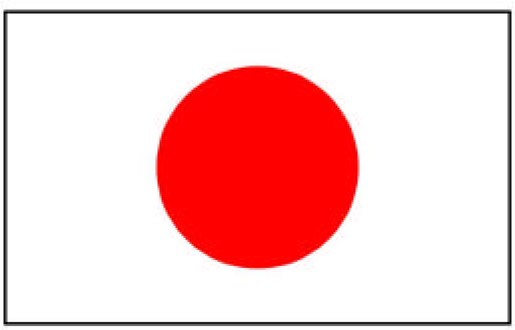
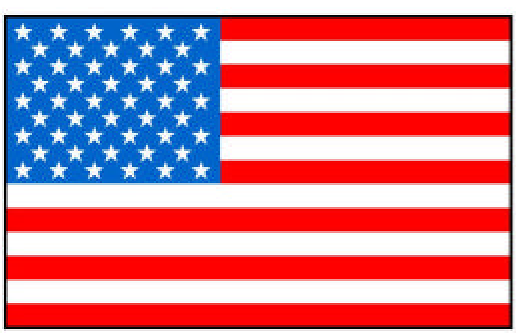
Eighth U.S. / Japan Workshop On Advanced Technology In Highway Engineering:

Nighttime and Pedestrian Safety



Proceedings



Federal Highway Administration
Washington, DC

November 15 ? 19, 1999

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Abstract

This report summarizes the 8th U.S.- Japan Workshop on Pedestrian and Nighttime Safety.
The workshop was hosted by the United States November 15-19, 1999, and was held at the Turner-Fairbank Highway Research Center. Five Japanese officials and researchers were invited to participate in the workshop. FHWA personnel, as well as several local and private sector representatives, participated in the workshop.

Focus areas included: general statistics and trends in the U.S. and Japan; pedestrian crashes; TEA-21 and pedestrian planning; disabled and elderly pedestrians; Geographic Information Systems (GIS) application for pedestrian safety; National Highway Traffic Safety Administration (NHTSA) activities; traffic calming in the U.S. and Japan; overview of nighttime crashes in the U.S. and Japan; and Japanese studies on traffic safety countermeasures at nighttime and ultraviolet lighting.

Both countries exchanged information through presentation of papers, formal discussions, and site visits. In conjunction with the workshop, the FHWA facilitated and arranged for the Japanese delegates to see pedestrian and nighttime technology applications in Seattle, Washington.

PEDESTRIAN and NIGHTTIME SAFETY in the U.S. and JAPAN WORKSHOP

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Introduction

In May 1992, a 5-year Implementing Arrangement between the U.S. Federal Highway Administration (FHWA) and the Ministry of Construction (MOC) of Japan on Highway Science and Technology was signed in Tokyo by Dr. T. Larson, FHWA Administrator, and Dr. H. Mitani, Vice Minister of Construction for Engineering Affairs, MOC. This arrangement was based on the "Agreement Between the United States of America and the Government of Japan on Cooperation in Research and Development in Science and Technology," signed in Toronto in 1988.

The U.S. and Japan agreed on the Implementing Arrangement to promote and enhance public safety and community welfare by fostering research, development, and improvement of highway structures and surfaces, and to promote, encourage, and advance a system of safer, more economical, efficient, and environmentally sound highway transportation through research, development, and cooperation. Both countries agreed that they would pursue cooperation through the free exchange of technical information, including a series of annual workshops and technical exchanges.

A new 6-year Implementing Arrangement for Advanced Technology in Highway Engineering between the FHWA and MOC's Public Works Research Institute (PWRI) was signed in January 1997, which continued cooperation, technical exchange, and annual workshops and technical meetings.

These workshops provide ongoing information on latest technologies of mutual interest. Workshop topics are selected cooperatively. Hosting alternates between both countries on an annual basis. A record of the proceedings is published by the host country.

The workshops between Japan's PWRI/ MOC and the FHWA have helped engineers in both countries gain better insight into engineering principles covering many areas of real interest to both countries. Successful activities in structures, design, highway safety, and ITS have resulted and been documented from these previous workshops.

In August 1997, a U.S.-Japan technical workshop was held at the Turner-Fairbank Highway Research Center in McLean, Virginia, which focused on environmental concerns related to noise (6th U.S.-Japan Workshop). Participants included representatives from government, the private sector, and academia. Both sides exchanged information through presentation of papers, formal discussions, and site visits.

In conjunction with the workshop, the FHWA facilitated and made arrangements for the Japanese delegates to visit Philadelphia (to see the implementation of noise walls) and San Diego (to participate in the ITS Automated Highway System Demonstration Project).

In 1998, U.S. representatives went to Japan to exchange information on advanced technology in highway engineering (7th U.S.-Japan Workshop) and were able to visit the Tokyo Trans-Bay Highway, Akashi Bridge (the longest suspension bridge in the world), and a reconstructed area in Kobe.

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This is an official record of the workshop. Its aim is to contribute to the development of highway science and technology in the United States and Japan and to establish a better transportation system.

Eighth U.S. / Japan Workshop
on
Advanced Technology in Highway Engineering:
Nighttime and Pedestrian Safety

Japanese Delegates

Makoto Nakamura, Chief, Road Department, PWRI
Hiroshi Kasai, Director of Parking Policy Coordination, Road Bureau, MOC
Katsuhiko Mitsuhashi, Head, Traffic Safety Division, Road Department, PWRI
Susumu Takamiya, Senior Researcher, Traffic Safety Division, PWRI
Kazuhiko Ando, Traffic Safety Division, Road Department, PWRI

PWRI = Public Works Research Institute
MOC = Ministry of Construction

U.S. Delegates

<u>Federal Highway Administration</u>

Dwight Horne, Director, Office of Highway Safety Infrastructure
Tamara Broyhill, Transportation Specialist, Office of Highway Infrastucture
John Fegan, Bicycle and Pedestrian Program Manager,
Office of Human Environment
Elizabeth Alicandri, Manager, Human Factors Laboratory
Davey Warren, Highway Research Engineer,
Office of Safety Research and Development
Carol Tan Esse, (Moderator) Pedestrian and Bicycle Safety Research
Program Manager
Dr. Sam Tignor, Technical Director, Office of Safety Research and Development
John Arens, Manager, Photometric Visibility Lab
Leverson Boodlal, Highway Transportation Engineer, Office of Highway Safety (Contractor)

<u>National Highway Transportation Safety Administration</u>
Marilena Amoni, Director, Office of Traffic Injury Control Programs
Dr. Maria Vegega, Chief, Safety Countermeasures Division
Lori Millen, Highway Safety Specialist, Office of Occupant Protection
Dr. Marvin Levy, Research Psychologist, Traffic Safety Programs

Other Organizations
Lois Thibault, Coordinator of Research U.S. Access Board
Charlie Zegeer, University of North Carolina, Highway Safety Research Center

1.0 Welcoming Remarks

1.1 FHWA Administrator Kenneth Wykle

Mr. Wykle, FHWA Administrator, welcomed the distinguished delegates from Japan. He stated that the workshops between Japan's Public Works Research Institute (PWRI), the Ministry of Construction (MOC), and the FHWA have helped engineers in both countries gain better insight into engineering principles of interest to both countries. The two workshops this year are the 8^{th} -Japan Workshop on Pedestrian and Nighttime Safety and the 7^{th} Workshop on ITS Activities in the United States and Japan.

The Administrator mentioned how proud he was of the long-standing cooperative relationship with the Ministry of Construction and the Public Works Research Institute. Initial activities began in 1968, and focused on wind and seismic concerns. In 1984, annual Joint Bridge Engineering Workshops were launched, facilitating inspections by structural and seismic engineers of quake damaged areas in Northridge, California, and Kobe, Japan, earthquakes. In May 1992, a 5-year Implementing Arrangement between the FHWA and the MOC was signed in Tokyo, which led to a series of annual workshops and technical exchanges. A new 6-year Implementing Arrangement for Advanced Technology in Highway Engineering between the FHWA and MOC was signed in January 1997. This agreement continued annual workshops and technical meetings. Beneficial results of previous workshops include successful activities in structures, design, highway safety, and ITS.

Mr. Wykle continued that Japanese representatives came to the United States in 1997 for formal meetings on noise-related environmental concerns. In conjunction with the workshop, site visits were organized to Philadelphia to see the implementation of noise wall. There was also a visit to San Diego to participate in the ITS Automated Highway System Demonstration Project. Tony Kane, FHWA Executive Director, and the Director General of the PWRI were in attendance.

Mr. Wykle noted that last year U.S. representatives went to Japan to exchange information on advanced technology in highway engineering. They were able to visit the Tokyo Trans-Bay Highway, Akashi Bridge, the longest suspension bridge in the world, and a reconstructed area in Kobe. He stressed that although much is accomplished at these workshops, equally important work continues between workshops as U.S. and Japanese technical experts work together. For example, Japan has hosted several teams from the FHWA technology exchange program, particularly in the areas of structures and ITS. The most recent was last May, when a U.S. team of steel fabrication experts witnessed remarkable innovations from Japan’s industry leaders.

Also, the FHWA finds the year-long ITS Fellow Program as enriching for the Agency as we hope it is for our guests from Japan.

In conclusion, Mr. Wykle stated that in the spirit of continuing cooperation, FHWA is confident the present workshop will be as successful and fruitful as previous ones.

1.2 Makoto Nakamura, Chief, Road Department, PWRI

Mr. Nakamura began by stating how honored he was to be able to meet Administrator Wykle on the occasion of the 8th U.S./Japan Workshop and the 7th ITS Workshop. He stated that since the 1992 bilateral agreement of cooperation, the FHWA and PWRI/MOC have been holding these workshops every year with the host country alternating between the U.S. and Japan. He expressed his pleasure that the success of the workshops continues to strengthen road technology cooperation between Japan and the United States. He conveyed special thanks to Mr. Wykle for understanding the importance of this cooperation and contributing to its promotion and development.

Mr. Nakamura went on to note that in Japan traffic crashes cause 10 thousand deaths and 1 million injuries each year. Iit is a pressing need for those engaged in transportation technolgy to solve this problem. Therefore, the timing of this workshop, with Traffic Safety as its theme, is ideal.

Conversely, among the six fields of the agreement, ITS is one of the few areas to hold its own workshop every year. According to Mr. Nakamura, this proves that cooperation between the two countries is proceeding very well. He thanked FHWA for accepting four Research Fellows from Japan, two of them, Mr. Iwasaki and Mr. Mori, were present at the workshop. In Japan, from next October to December, the Ministry of Construction is planning on having an Advanced Cruise-Assist Highway Systems (AHS) demonstration on the PWRI test course. (This demonstration will be held jointly with the Automated Safety Vehicle project of Japanese Ministry of Transportation.) Mr. Nakamura expressed his hope that FHWA would participate in the demonstrations. He thanked FHWA for taking care of Mr. Kubuchi through the fellowship system and looked continuing the program and further strengthening interaction between the U.S. and Japan.

Finally, Mr. Nakamura extended his gratitude to the FHWA staff who prepared the Workshop, and expressed hope that this U.S./Japan Highway cooperation will not only continue, but will also go a long way toward U.S./Japan relations.

2.0 Overview of FHWA Safety Initiatives

2.1 Dwight Horne, Director for the Office of Highway Safety Infrastructure

Mr. Horne began by noting that the Federal Highway Administration is the part of the Department of Transportation that focuses on roadway safety. Specifically, the focus is on the roadway itself, road hardware (such as guard rails and barriers), and traffic control devices such as signs, signals, and pavement markings. However, other organizations within the Department of Transportation are also concerned about pedestrian safety.

He continued that on a national scale, the Federal Highway Administration manages the Federal-aid Highway Program, which provides Federal financial assistance to States to construct and improve the National Highway System, urban and rural roads, and bridges. The program provides funds for general improvements and development of safe highways and roads. Each State has its own department of transportation that plans and oversees all roadway projects within that State, including those projects for pedestrians, such as the installation of sidewalks and pathways. The State DOT role is to determine which roadway projects are needed and to plan for their completion. Generally, plans are made up to 20 years in advance. Each State is comprised of smaller localities, such as cities and counties that also have their own departments of transportation. Roadway projects are planned and divided into these localities under the direction of the State Department of Transportation.

The Federal Highway Administration promotes the best available safety practices and technologies in all phases of highway design and operations. This is done by (1) conducting safety research, (2) developing safety-related guidelines and policies for the States and localities to follow, (3) developing brochures and other products that provide information on our programs and general safety advice, and (4) offering technical assistance when needed.

Mr. Horne went on to note that pedestrians represent 14 percent of all traffic fatalities, with children and the elderly being overly represented. More than 5,000 pedestrians are killed annually. This is the equivalent of a plane crash every 2 weeks that results in the deaths of all 200 passengers.

Mr. Horne concluded by noting that although FHWA does not have the authority to design and construct pedestrian facilities, the Agency promotes the safety of pedestrians by encouraging States to consider the needs of pedestrians and plan for their safe accommodation when designing roadway facilities. In addition, FHWA offers technical assistance by going directly to communities and helping them identify their pedestrian safety problems and develop engineering solutions.

2.2 Marilena Amoni, Director, Office of Traffic Injury Control Program, NHTSA

Ms. Amoni began by stating the National Highway Traffic Safety Administration's (NHTSA) mission is to save lives, prevent injuries, reduce traffic-related health care, and lessen other economic costs. NHTSA does this by establishing national motor vehicle safety standards, conducting research, and developing programs to improve the performance of drivers, pedestrians, and others. By assessing behavioral risk factors known to lead to much higher rates of death and injuries in motor vehicle crashes, NTHSA conducts research on why people behave irresponsibly and develops strategies to try to change high-risk habits.

Walking is the second most used mode of travel. The 1995 Nationwide Personal Transportation Survey indicated that approximately 56 million walking trips take place every day in the U.S.

Ms. Amoni noted that September 14, 1999 was the 100th anniversary of the first motor vehicle/pedestrian crash fatality. Over the century, automobiles have killed more than 700,000 pedestrians. In the last 10 years, the number of pedestrians killed in traffic crashes has decreased by 24 percent. On average, a pedestrian is killed every 101 minutes and injured every 8 minutes. In 1998, 5,220 pedestrians were killed and 69,000 were injured. Most 1998pedestrian fatalities occurred in urban areas (69 percent), at non-ntersection locations (78 percent), in normal weather conditions (88 percent), and at night (64 percent). The average cost per injury of a pedestrian-car collision victim is $247,000. The annual cost to the Nation is $10.4 billion in medical care, lost wages to employers, legal costs, vocational rehabilitation, and property damage.

When speaking with motorists who have been involved in crashes with pedestrians, one statement commonly heard ? "I never saw him/her until it was too late to do anything."

Ms. Amoni continued that children, older adults, and impaired pedestrians are the three groups most at risk for involvement in pedestrian crashes. NHTSA concentrates on these three groups and uses research to identify potential problems and solutions and to develop pedestrian safety programs and materials that enable communities to take charge of their pedestrian issues. NHTSA also provides funding and technical assistance to States, communities, and national organizations, encouraging them to work together to implement pedestrian safety initiatives.

The FHWA and NHTSA have initiated a pedestrian safety strategy called the 3E's ? Engineering (FHWA), Education, and Enforcement (NHTSA) ? and they continue to work jointly on several projects. An example is the *Secretarial Initiative for Pedestrian and Bicycle Safety*, which promotes walking and bicycling as safe, efficient, and healthy ways to travel. The *Secretarial Initiative* sets two goals: by the Year 2000, reduce the number of injuries and fatalities to bicyclists and pedestrians by 10 percent,and double the national percentage (from 7.9 percent to 15.8 percent) of transportation trips by bicycling and walking.

NHTSA also partners with other organizations and works through existing programs. For example, Safe Communities is designed to reduce transportation- related injuries through community leadership, citizen involvement, and by using a multidisciplinary intermodal approach to address key injury problems. NHTSA is a founding and active members of the *Partnership for a Walkable America.* The Partnership has sponsored *National Walk Our Children to School Day* for the last 3 years.

NHTSA also promotes the positive aspects of increased levels of walking ? health and physical fitness, not polluting the environment, transportation-related effects, alternative travel options, and reduced urban congestion.

2.3 New 5-Year Program for Road Technology in Japan

Makoto Nakamura, Chief, Road Department, PWRI

Mr. Nakamura began his presentation with the Ministry Of Construction organization chart and the Public Works Research Institute organization chart after a recent government reorganization.

He noted that the Road Bureau and the Public Works Research Institute of the Ministry of Construction have formulated a New 5-Year Program for Road Technology in Japan, desgined especially to contribute to the creation of a vibrant society.

There are five considerations in formulating this program:

1) Determine the range of the technology research and development activities that the national government has to implement.

2) Comprehensively integrate government, road administration, and technology research and development activities.

3) Prioritize technology research and development themes.

4) Specify how to improve technology research and development.

5) Establish evaluation systems of technology research and development activities.

The new 5-year program (FY 1998 to 2002) invests 78 trillion yen to support the improvement and management program. According to Mr. Nakamura, the annual budget for PWRI is 18.95 billion yen ? 10.18 billion yen for research, of which 4.08 billion yen is for highway works. There are four major research categories to improve:

- The Road Environment
  - Improving the road-side environment
  - Preserving and rehabilitating the natural environment

- Safety and Security of Roads and Daily Life
  - Development of AHS
  - Evaluation of seismic motion
  - Risk management for bedrocks and landslides

- The Efficiency of Road Traffic and Road Projects
  - Reinforcing bridges and pavement
  - Strengthen the transportation linkages
  - Realizing the TDM policy
  - Winter road management
  - Minimizing the Life Cycle Cost
  - Efficient road plan and design
  - Constructing new transportation links
    - accountability
  - Developing systems for assessing road policies

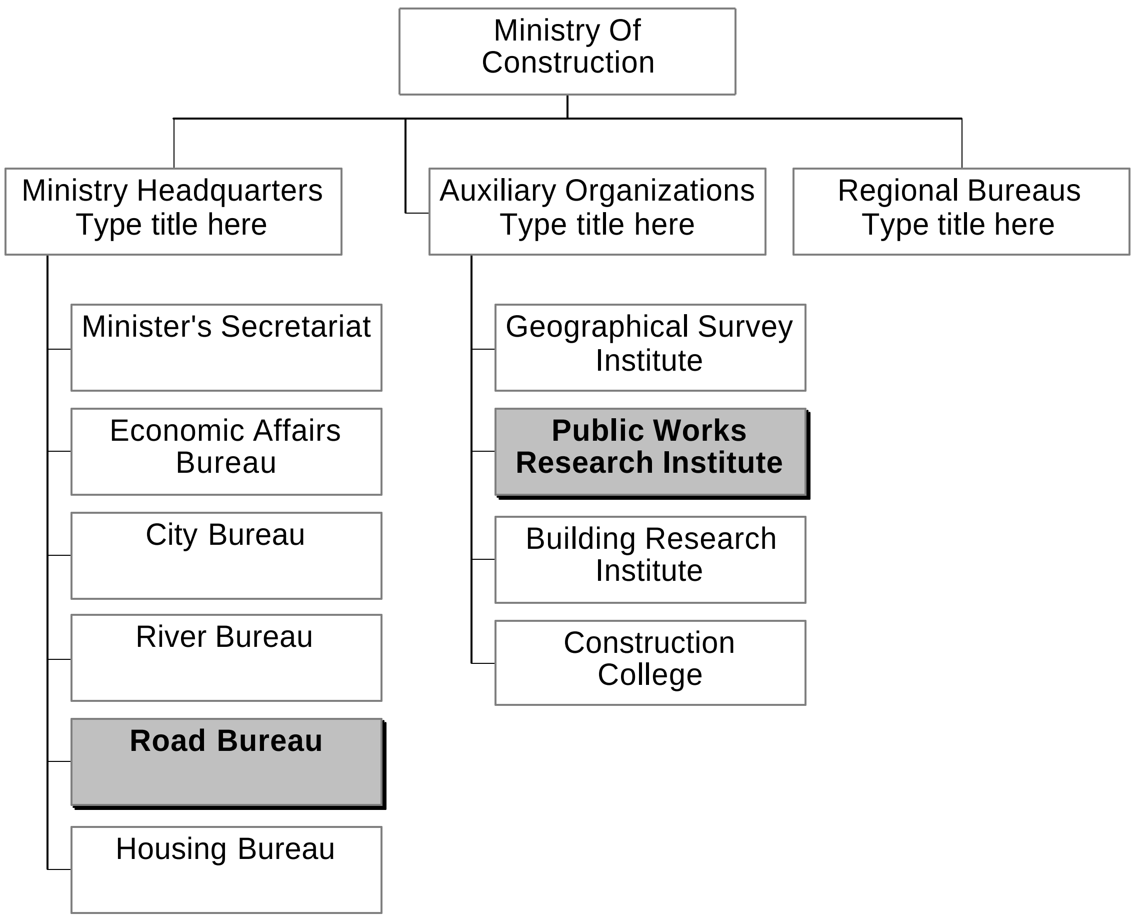
Mr. Nakamura noted that with a rapidly aging society, falling birthrates, and a declining working population, the social and economic structure in Japan is expected to diversify and change dramatically in the next century.

To meet these changes, and to build a safe, secure, and vibrant society, it will be necessary to use the limited land area effectively and to manage it appropriately. The PWRI/MOC is being required to develop and maintain roads as an indispensable and fundamental social infrastructure.

Mr. Nakamura continued that this will require the comprehensive integration of a road engineering with road policy in order to maximize the social value of rosds, and expand their usefulness. This comprehensive road policy, including road engineering, is expected to play a major role.

He concluded that in the future, the PWRI/MOC will make its best efforts to implement the new 5-Year Program for Technology in Japan and will successfully meet the kind of social needs to resolve environmental problems, save energy, promote safety and security, and improve efficiency with the understanding and cooperation given by the general public.

Japan Ministry of Construction



Japan Public Works Research Institute

- Director General
  - General Affairs Department
  - Planning & Research Administration Dept
  - Environment Department
    - Traffic Environment Division
    - Landscape and Ecology Division
  - River Dept.
  - Water Quality Dept.
  - Dam Dept.
  - Erosion and Sediment Control Dept.
  - **Road Dept.**
    - **Traffic Engineering Division**
    - **Intelligent Transportation Division**
    - **Traffic Safety Division**
    - **Pavement Division**
    - **Tunnel Division**
  - Materials Construction Department
  - Structure and Bridge Department
  - Research Center for Public Works Management
  - Earthquake Disaster Prevention Research Center
  - Niigata Experimental Laboratory

2.4 Overview of Japanese Safety
Hiroshi Kasai, Director for Parking Policy Coordination, Road Bureau, MOC

Mr. Kasai began by stating that the new Five Year Road Improvement Program has renewed an ongoing emphasis on traffic safety measures. Japan's road death statistics in 1997 totaled 9,640 victims. Although the death toll was below the 10,000 mark as in the preceding year, the number of traffic crashes and injuries recorded a new high for the fifth consecutive year. Crashes numbered 780,339 and injuries totaled 958,925.

A disturbing trend has been the sharp increase in crashes involving the elderly (aged 65 and over). This age bracket accounted for approximately 30% of all deaths, and represented the highest share of death statistics by age group, exceeding that of the younger population (aged 16-24).

A seven-year Traffic Safety Facilities Improvement Program has been drawn up to meet urgent traffic safety needs. The plan includes car parks, traffic information, improvement of road junctions and creation of pedestrian facilities. Basic policies under the plan include:

- Implementation of urgent measures for accident black spots

- Development of pedestrian spaces to facilitate the mobility of the elderly

- Establishment of a barrier-free pedestrian space network

  Infrastructure improvements are being made to accommodate pedestrians and cyclists. Wide pedestrian walks, ramps, gradients, slopes and other enhancements are creating barrier-free networks of pedestrian spaces, particularly in heavily used locations such as around inner city train stations, shopping areas and hospitals.

- Implementation of Community Zone Development projects

  In residential areas, through traffic is being mitigated by creating community roads and mixed pedestrian-vehicular roads.

- Commitment to safety from the road user's perception

The different types of construction work for Specified Traffic Safety Facilities Improvement Projects include:

Category 1: Projects for Road Improvement

Pedestrian Walks:

- -Pedestrian-only ways
- -Shared pedestrian and bicycle lanes
- -Bicycle lanes
- -Pedestrians and bicycle only lanes
- -Community Roads
- -Community Zone Development Project (new)
- -Mixed pedestrian- vehicular roads (new)
- -Pedestrian overpass or underpass road crossings

Category 2: Projects involving road accessories and demarcation lines

- -Road lighting

The New Five-year Road Improvement Program is to take planned emergency action to improve Japan's road infrastructure in qualitative and quantitative terms and meet public needs for mobility, economic and lifestyle qualities by creating greater safety for people. The investment for involves 78 trillion yen over a period from fiscal 1998 through 2002. The plan reflect the demands of the general public for road infrastructure measures and heeds the findings of the Road Inquiry Committee (Construction Debate) published under the title "Proposals for a Change in Road Policy–Towards Higher Social Values." The plan aims to:

-Support economic structural reform

-Support the development of dynamic regions and cities

-Securing a better environment

-Realization of a safe-to-live-in national territory

New Five Year Plan (fiscal 1998 through 2000)

Planned for Amount	Planned for Amount unit: 100 million yen	Incremental Factor
General Road Construction	292,000	1.01
Toll Road Construction	170,000	0.83
Subtotal	462,000	0.94
Separate Regional Projects	268,000	1.06
Total	730,000	0.98
Cost Adjustment	50,000	3.57
Total	780,000	1.03

Specific measures under the plan include:

-Centralized implementations of plans to reduce crashes on the basis of scientific methods

-Implementation of urgent measures for accident black spots

Facts show that 40% of all traffic accidents at trunk roads are concentrated in only 9% of the total area. Therefore measures are implemented centrally to reduce accidents in accident black spots and the vicinity of such accident-prone locations by improving road junctions, providing pedestrian ways, and installing road lighting.

-Community Zoning Projects

In areas in which priority should be given to the flow of pedestrian traffic, area-wide infrastructure development efforts involving the creation of community roads and mixed pedestrian-vehicular roads will be made by road administrators in conjunction with traffic control through the Prefectural Public Safety Committees. The purpose is to curtail the intrusion of through-traffic and secure peace and safety in residential neighborhoods.

Community roads are designed to bring pedestrian and vehicular road use into a harmonious balance by controlling vehicle speed through measures such as the provision of zig-zag car lanes to allow shared use with pedestrians

Mixed pedestrian pedestrian-vehicular roads: aimed at crowded roads, the goal is to give priority to pedestrians and control vehicular traffic through a combination of measures, including humps and tapering.

-Area-Wide Infrastructure Development of Pedestrian Spaces to Support Social Involvement of the Elderly

High-quality and safe barrier-free pedestrian spaces are being developed to create living environments that accommodates the safety of the elderly and the handicapped.

Network of barrier-free pedestrian spaces

Infrastructure development in 280 designated areas is underway to provide wide pedestrian roads or lanes so that all road users can safely use the road. This includes wheelchairs and electric three-wheeled vehicles and

applies to inner city station areas, shopping zones, hospital surroundings, including the use of step-free buses around hospital zones.
Network development of barrier-free pedestrian spaces means an area in which a network of wide (generally 3m or more in width) pedestrian ways with suitable ramps, inclines gradients have been developed to permit the safe passage of wheelchairs. Target areas are residential and commercial areas of 1sq. Km.
Target roads include main routes in areas connecting to stations, shopping centers, and welfare facilities.

Creation of wide pedestrian walkways

Infrastructure development is in progress to create wide pedestrian walkways (general 3m or more in width) to permit safe passage for the elderly and handicapped and secure amenities and safety for pedestrians and cyclists.

Apart from the development of wide pedestrian walkways, existing pedestrian sidewalks will be cut back to set them off against the road (ramp construction) and a suitable incline or gradient will be provided. This will create a pedestrian environment that lets the elderly and handicapped use the road safely. To ensure traffic safety for the visually handicapped, guide blocks will be provided on roads heavily used by these pedestrians and on roads connecting to stations and bus stops.

Bicycle Parking Spaces and Burying Electric Cables Underground

Bicycle parking on guide blocks for the visually handicapped creates barriers, particularly for the visually impaired. To eliminate these barriers while providing adequate bicycle parking spaces, bicycle parking will be provided in station squares and shopping and shopping or commercial districts.

Easy-to-Use Overpasses/Underpasses at Road Crossings

Easy-to-use overpasses or underpasses are being built mainly in the vicinity of facilities extensively used by the elderly and handicapped people, such as train stations. Slopes, elevators, pedestrian decks and direct corridors to buildings are provided, as appropriate.

Creating cities with a "human face"

Construction work is underway to build structures for use by all members of society, including the elderly. The aim is to provide integrated movement networks in inner city areas by concentration of priority infrastructure projects such as the creation of movement systems and traffic safety facilities in order to secure safety and amenity in traffic movement for the elderly and the handicapped.

Creating pedestrian spaces in nodal traffic points such as station squares

To provide greater amenity and user comfort in facilities such as station areas used by many people, the pedestrian spaces are provided in nodal traffic points such as station squares and bus stops in cooperation with bus and rail operators. Elevators are also being installed in stations.

Commitment to Traffic Safety from the User's Perspective

General Traffic Safety Checks

Improvements are made to the road environment on the basis of user participation involving the local citizens and the road users. This integrated approach harnesses the efforts of the public and private sectors, companies and individual alike, and is designed to ensure traffic safety with practical traffic safety education through participation and trial.

Survey on School Route Safety Checks

Surveys have been carried out to check the width of walkways and the eye-level of children (height of line of view) for facility projects including traffic safety facilities such as school routes for children and overpass/underpass road crossings. These efforts aim to secure the safety of children in traffic on their way to school, and the studies were conducted in cooperation with the schools.

3.0 PEDESTRIAN CRASHES

3.1 U.S. Pedestrian Crashes

Tamara Broyhill, FHWA, Office of Highway Safety Infrastructure

Ms. Broyhilll began by summarizing the average ages of pedestrians involved in all crashes as:

Age	% of Crashes
0-9	19%
10-14	11%
15-19	11%
20-24	9%
25-44	29%
45-64	12%
65 plus	9%

She continued with an overview of how the pedestrian/vehicle crashes occurred.

Vehicle turn and merge

Vehicle turn and merge (9.8 percent of all crashes) were the most common crashes. They occur when the pedestrian and vehicle collide while vehicle was preparing to turn, was in the process of turning, or had completed the turn. Crashes were:

??More likely to involve an adult (33 percent vs. 29 percent for all pedestrian crashes).

??Less likely than average to involve a child (4 percent vs. 11 percent).

??More likely than average to occur during the day (72 percent vs. 60 percent).

Mid-Block Dash

The next most common crash is the mid-block dash (8.7percent of all crashes), which involves a pedestrian running between blocks and being struck by a motorist whose view was unobstructed. This crash type is more likely than average to:

??Involve a child (51 percent vs. 19 percent).

?? Less likely than average to involve an adult (12 percent vs. 29 percent).

??More likely to occur during the day (70 percent vs. 60 percent average).

Not in Roadway Crash
A pedestrian being struck in a parking lot, driveway, sidewalk, private road, service station, or yard accounts for 7.9 percent of all crashes. More than half occur in parking lots This crash is more likely than the average of all pedestrian crashes (68 percent vs. 60 percent) to occur during the day.

Walking Along Road
A pedestrian struck while walking or running along a road without sidewalks. (7.4percent) is more likely than average to:

?? Involve an adult (42 percent vs. 29 percent).

?? Less likely than average to involve a child (1 percent vs. 19 percent).

?? More likely than average to occur at dark (41 percent vs. 12 percent).

Intersection Dash
A pedestrian struck while running through an intersection (7.2 percent), and/or the motorist's view was blocked until just before impact, is more likely than average to:

?? Involve a child (41 percent vs. 19 percent average) or a youth (23 percent vs. 11 percent).

?? More likely than average to occur during the day (71 percent vs. 60 percent).

Backing Vehicles
A pedestrian struck by a vehicle backing up (6.9percent) is more likely than average to:

?? Involve an elderly person (18 percent vs. 9 percent).

?? More likely than average to occur during the day (72 percent vs. 60 percent).

Driver Violation at Intersection
A pedestrian struck by vehicle (5.1 percent) whose driver failed to yield, went through STOP sign or signal, was speeding, or involved another violation had a normal age profile, but the crash is more likely than average to occur in dark but lighted conditions (11 percent vs. 1 percent).

Mid-block Dart Out
Crashes occuring at a midblock location (4.6 percent) where the motorist's view of the pedestrian was blocked until an instant before impact are much more likely than the average of all pedestrian crashes to:

??Involve a child (62 percent vs. 19 percent).

??More likely than average (80 percent vs. 60 percent) to occur during the day.

Ms. Broyhilll concluded that the summary of crash typology identifies 37 individual crash types ? the 8 mentioned above account for more than half of all crashes. The majority (60 percent) of all the crashes take place at intersections and midblock locations. Sixty percent of the pedestrian fatalities occur in the evening/early morning hours between 6 p.m. and 6 a.m.

3.2 Japanese Pedestrian Crashes

Katsuhiko Mitsuhashi, Head, Traffic Safety Division, Road Department, PWRI

Mr. Mitsuhashi began by informing participants that in Japan the traffic crash rate increased steadily until 1970, with pedestrian crashes reaching 171,027. By constructing sidewalks, installing traffic signals, and instituting other traffic safety measures, the number of pedestrian traffic crashes was reduced to fewer than 100,000 by 1978. Despite this slight decline in 1978, the rate of their occurrence has remained level. In recent years, there has been an increased number of accidents involving elderly pedestrians, which primarily reflects the aging of Japanese society. Measures are necessary to reduce crashes involving the elderly and children (because of declining birth rate).

Mr. Mitsuhashi first defined the following terms:

Pedestrian Crash
Is a pedestrian-motor vehicle crash in which the pedestrian was killed or injured.

Crash Categorization
A fatality refers to the death of a victim of a traffic crash within 24 hours after the incident. A serious injury is an injury suffered by a victim of a traffic crash and which requires month (30 days) or more of treatment. A minor injury is an injury suffered by a victim of a traffic crash and which requires less than one month (30 days) treatment.

Topography
Topography is categorized as urban land and non-urban land that is not part of urban land. Urban land is a so-called urbanized region where there are continuous dwellings, commercial buildings, etc., extending for 500 meters or more along a roadside and buildings occupy 80 percent or more of the land in the region.

Arterial Road/Non-Arterial Road
Roads other than National Expressways and Motor Ways are classified according to road category and road width and configuration as non-arterial roads or as arterial roads: all roads that are not non-arterial. Non-arterial roads are roads that are ordinary city streets without medians and with a traffic lane width narrower than 5.5 m and roads in urban regions without sidewalks and a traffic land width of at least 5.5m and less than 9.0 m.

The number of both fatalities and injuries by age group reveals that in 1997, 2,643 people were killed, a high percentage of them being elderly. In 1997, 81,751 people were killed or injured in pedestrian crashes. When classified by age group, many of those killed or injured were 65 and older or 12 and younger. The number of fatalities and the number of fatalities and injuries per 100,000 population by age group, indicate that incidents involving people aged 65 and older and 12 and younger are both high.

Crashes involving no illegal acts by pedestrians account for 44.3% of all pedestrian crashes. Among those accidents that did involve an illegal act, "running into the road" is the most common at 12.8 percent. This is followed by crossing outside of a pedestrian crossing at 8.3 percent, and "crossing directly in front of or behind a moving vehicle" at 7.9 percent. Among victims 12 years and younger, 78.2 percent of crashes involved an illegal act, a higher value than for any other age group. For the two highest categories of illegal acts, running into the road accounts for 36.2 percent, and crossing directly in front or directly behind a parked vehicle follows at 10.3 percent.

Sixty-one percent of crashes occur in the daytime. When categorized by age group, daytime crashes account for a large percentage of accidents involving people 12 years and younger and those 65 and older. The crash rates for pedestrians between 12 and 64, however, are about equal.

The frequency of pedestrian accidents increases after 6:00 a.m, with the morning peak at about 8:00 a.m., with the rate falling a little toward noon. The rate rises again after 2:00 p.m., peaking at 5:00 p.m., when 10.3 percent (8,405 people) of accidents occur, the most of any time during the daytime. When focusing on crashes occuring by time of day for various age groups, it is noted that for those age 12 and younger, a small peak is seen between 7:00 a.m. and 8:00 a.m., with a larger peak between 3:00 p.m. and 5:00 p.m. Most crashes involving young victims occur while people are going to and returning from school, and after school. For victims 65 and older, the peaks are between 10:00 a.m. and 11:00 a.m. and between 5:00 p.m. and 6:00 p.m.

The occurrence of crashes by location (distance from the victim? s home) for pedestrians 12 and under and those 65 and older, shows that more than 60 percent occur within 500 m of the victim? s home, indicating that many crashes occur close to home.

A breakdown by topography shows that 80.7 percent of crashes occur in urban regions. Mr. Mitsuhashi noted that of road types, 42.1 percent of crashes occur at intersections and 46.4 percent occur on a road section. This type of analysis reveals that a high percentage of crashes occur both at intersections in urban regions and on road sections in non-urban regions.

The distribution of crash types varies sharply according to road type. At intersections, 52.4 percent of crashes occur while a pedestrian is crossing. Accidents while crossing in other ways was at 26.2 percent. Crossing in other ways refers to an crash occuring at a place that is neither at/or close to a pedestrian crossing, nor is it close to a pedestrian crossing bridge.

For non-urban road sections, 47.6 percent of accidents occurred while pedestrians crossed in other ways. This is followed by “hit from behind while walking” at 14.8 percent. This type of accident occurs when a pedestrian walking along a road is struck from behind by a vehicle.

When crashes are separated by type, they involve four groups: arterial and nonarterial roads in urban and in nonurban regions. It appeared that on arterial roads in urban regions, the most frequent type of crash ? 38.8 percent ? involved a pedestrian at a crossing, This was followed by 35.1 percent of crashes that occurred while crossing other ways. On arterial roads in nonurban regions, while crossing other ways was the most common at 43.9 percent, crossing in a pedestrian crossing was at 17.1 percent. On nonarterial roads, conversely, crossing in other ways was the leader as many crashes occurred while a victim was walking along a road.

In terms of crashes during daytime/nighttime and by road width, roads 5.5 m or more wide but less than 9.0 m, are the scenes of most crashes at 51.5 percent,. Accidents on roads narrower than 9.0 m account for more than 70 percent of all accidents. Daytime crashes occur most frequently on narrow roads, while most nighttime crashes occur on wide roads.

Crashes by road category show that 56.5 percent of crashes occur on the streets of cities, towns, and villages. This is followed by national highways at 14.8 percent and major regional roads at 13.8 percent. A look at the number of crashes per kilometer of road reveals that the highest rate is found on national highways at 0.22 accidents/kilometer. This is followed by 0.19 crashes/kilometer on major regional roads and 0.12 crashes/kilometer on ordinary prefectural roads. Pedestrian crashes almost never occur on national expressways and motor ways because pedestrians are prohibited on these roads.

In conclusion, many of those killed or injured in pedestrian crashes are 12 and younger and 65 and older. Children and the elderly are frequently the victims of crashes during the daytime because that is their principal period of activity. Additionally, children and the elderly are victims of crashes near their homes and on narrow roads they use on a daily basis. Pedestrian crashes occur both at intersections and on road sections, with many crashes at intersections occurring as the pedestrian crosses the road. Many crashes on road sections also occur while the pedestrian is crossing or walking along the road.

4.0 TEA-21 AND PEDESTRIAN PLANNING

4.1 US Legislation and Pedestrian Considerations During the Planning Process

John Fegan, Bicycle and Pedestrian Program Manager, OST

Mr. Fegan began by citing The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21) ? two legislative acts that directly affect how bicyclists and pedestrians are included in our Nation's transportation system.

ISTEA and TEA-21 called for a change in our Nation's transportation system, which currently emphasize the use of the private motor vehicle over other modes of transportation. This strategy has significantly disadvantaged individuals who don't have access to a private motor vehicle because of age, economic factors, or because they choose not to own one.

Federal transportation funding is transmitted to the States and Metropolitan Planning Organizations (MPOs) of the nation by a formula. The States and MPOs can use this funding on eligible activities, which include facilities and program for pedestrians (as well as persons with disabilities) and bicyclists.

Mr. Fegan noted that of the Federal funding used for bicycle and pedestrian projects, 75 percent has come from the Transportation Enhancements Funding program. Another 10 percent has come from the Congestion and Mitigation Air Quality Program. Funds may be used for on- or off-road facilities such as trails. Bicycle projects must serve a transportation purpose and, with a few exceptions permitted by law, motorized vehicles are not allowed on these facilities.

The mechanism for States and MPOs to access Federal transportation funding is through the State and MPO transportation planning processes. States and MPOs must develop long-range (20-year) transportation plans and a list of projects to be funded over the next 3 to 5 years. If projects are not included, they cannot receive Federal transportation funds. Projects benefitting pedestrians and bicyclists must be included on the lists of projects if they are to receive funding.

5.0 DISABLED AND ELDERLY PEDESTRIANS

5.1 Protecting Pedestrians with Disabilities

Katsuhiko Mitsuhashi, Head, Traffic Safety Division, PWRI

Mr. Mitsuhaski began his presentation by addessing the fact that the aging population of Japan has increased faster than anywhere else in the world. As of 1995, the population of elderly persons, namely those aged 65 or older, accounted for 14.5 percent of the total population. The data collected indicate an estimated increase in the population of those aged 65 or older of 17.2 percent in 2000, 22.0 percent in 2010, and 25.2 percent in 2015 ? suggesting the advent of a society where one out of four Japanese citizens is 65 or over.

The modes of transportation for elderly and disbled persons will include walking or using the bicycle, car, bus, and special transport. Among these transportation modes, walking enables free individual transfer with no care or assistance requirements.

Definitions of terms frequently used in this presentation are as follows:

Sidewalk and bicycle/pedestrian track
The sidewalk is defined as the section for pedestrian passing located next to the road. The bicycle/pedestrian track is defined as the space commonly used by pedestrian traffic and bicycle traffic. These are distinguished from the road by the curbstone.

Sidewalk termination point
The sidewalk termination pint is defined as the section where the sidewalk is cut at the intersection between a road with a sidewalk and a road with no sidewalk such as the minor street. Since the pedestrian who walks along the sidewal must cross the road along the pedestrian crossing, the sidewalk is partially cut.

Vehicle exit/entrance point.
The vehicle exit/entrance point is defined as the section where the curbstone or the sidewalk is cut to enable the vehicle to enter private land located along the road.

Guiding block for the visually disabled person
The guiding block for the visually disabled persons is defined as the block with projections on the surface so that the visually disabled persons can feel the existence and the general shape of the block mainly on the sole of the shoe. The guiding block is designed to help the visually disabled person to check the correct walking position and walking direction.

Japan has set a goal of starting the construction of barrier-free pedestrian space in some 3,200 areas by 2002.

The basic dimensions necessary to meet the needs of disabled pedestrians are based on the width of the hand-operated wheelchair, which is set at 63 cm (JIS), and the electric wheelchair, which is is set at 70 cm (ISO and JIS). Considering the actual conditions of wheelchair use ? operating the wheelchair by the arm and by the caregiver pushing the wheelchair from the back ? the width necessary for wheelchair passing was set at 1 m. In addition, the use of the so-called silver car (motorized cart) is increasing. Therefore, the width necessary for the passage of the silver car was taken into consideration.

Planners then took into consideration the need for two wheelchairs traveling from opposite directions to set the width of the sidewalk and bicycle/pedestrian track traveled by the road users at a minimum of 2 ms. The width of the bicycle/pedestrian track was set at a minimum of 3 m after taking into consideration two wheelchairs traveling from opposite directions and the passing of the a bicycle.

The grade found on the local sidewalk and the level difference along the border between the sidewalk and the road are stipulated as technical standards. The heights of the sidewalk are set at a 15-cm standard to ensure safe passage of the pedestrian and the vehicle and by considering roadside conditions. This value is merely a standard. The height can be increased or decreased if there is a need to improve safety or if safety is considered sufficiently.

The following stipulations apply to grades locally found at the sidewalk termination point and the vehicle exit/entrance point:

??In the traveling direction of the pedestrian, grades should be no greater than 5 percent.

??Grades up to a maximum of 8 percent are allowed when roadside conditions make it unavoidable.

??Sidewalk cross-slopes (grades at right angles to pedestrial travel direction) should be no greater than 2 percent.

Then, a continuous flat section of at least 1m is set in principle to ensure passage safety of those using the wheelchair on the sidewalk. The flat section is defined as a section with a lateral grade of 2 percent or less. This provision is aimed at enabling pedestrian passage at the vehicle exit/entrance.

The grade found along the pedestrian passage section should be the same for the structure of the sidewalk termination point. The level difference between the sidewalk and the road should be 2 cm to both enable passage of those in a wheelchair and help the visually disabled person to recognize the border between the sidewalk and the road. A space about 1.5 m long should be reserved to enable those using the wheelchair to stop between the grade and the section with level difference.

This grade should be similar for the structure of the vehicle exit/entrance point, the grades found along the section of pedestrian. Vehicle performance should be taken into consideration in setting the values representing the grade and the level difference in the section entered by a vehicle. Depending on the sidewalk width, there may be cases where the height of the entire sidewalk may be lowered.

A guiding block for visually disabled persons is installed in order to direct them to the correct walking position and direction on the road, to ensure their safety on the road, and to help the visually disabled persons participate in social activities. The block shape and the installation method are stipulated by the technical standards enacted in 1985.

The guiding block for the visually disabled persons, which is a block made with projections on the surface, was devised to help visually disabled persons, totally blind persons and weak sighted person, to recognize the existence of the block. This also gives direction of the walking position, direction based on the sole of the shoe, and the difference in color with that of the neighboring road. Two types of guiding blocks are available:

??The linear block has linear, parallel projections and is mainly designed to indicate the direction of the target facility and indicates the walking direction for the visually disabled person.

??Spot block has spot projections and is mainly designed to indicate the location needing particular attention and the position of the target facility. Spot blocks are set up along the border between the sidewalk and the road to warn visually disabled persons of the border.

In conclusion, Mr. Mitsuhaski stated that Japan will continue to address the needs of elderly and disable pedestrians by looking at general residential area roads with no sidewalks and by addressing ascending and descending section of grade separation facilities, which are mostly steps. The installation of the slope or the elevator in such a section will make it easier for elderly and disabled persons to access such facilities. To ensure the use of about 3,200 barrier-free pedestrian spaces, it is important to inform elderly and disabled persons of the barrier-free space locations and indicate the recommended routes to their destination. For this reason, using the guide sign for the pedestrian is one effective means to achieve this goal.

5.2 Barrier-Free Measures for Pedestrian Space

Susuma Takamiya
Senior Researcher, Traffic Safety Division, PWRI

Mr. Takamiya began by emphasizing the need to address the continuing aging of the population Japan. Measures that provide for the needs of the elderly and disabled people are being widely introduced in society, including housing and transportation environments. It is understood that the elderly and disabled have problems as they walk on roads. "Barrier free measures" are measures to help elderly and disabled people especially while walking.

A common problem of obstructing pedestrian movement is where a sidewalk has been hastily constructed at a location where it is needed to prevent traffic accidents, but the sidewalk suddenly ends or is discontinued. This situation causes the elderly and disabled to walk on the shoulder of the road beside a traffic lane. The space provided for pedestrians is narrow, preventing elderly and disabled people from passing through it safely and confidently.

A steep grade on a sidewalk impedes the passage of wheelchairs. There is a risk of wheelchairs rolling towards the road and into a traffic lane where a sidewalk has a steep lateral grade or combined grade descending towards the traffic lanes.

If the level difference between a sidewalk and the traffic lane is high at the end of the sidewalk, wheelchairs cannot pass from the traffic lane to the sidewalk and the elderly pedestrians may trip. This situation is also true for the visually impaired because they must distinguish the sidewalk from the traffic lane.

Using overpasses and bridges presents difficulties for the elderly and people with disabilities because of the required exertion to cross the additional vertical and horizontal distance.

Barrier free measures must be planned with continuity in mind to accommodate for pedestrians. It is important to provide space for pedestrians so they may move safely and without anxiety. Space for pedestrians are assumed to include not only sidewalks, but also community roads and shared vehicle – pedestrian roads, and other neighborhood roads. To provide continuous space for pedestrians, the continuity of pedestrian space should be checked at the planning stage and then included in the plans.

Sufficient space and width of sidewalk is necessary for the elderly and people with disabilities so they can pass through confidently. A sidewalk must have adequate width for pedestrians to both meet and pass, and to overtake the pass each other. This width should be required at locations of the stairs landings at grade separation facilities or other road structures. Guide blocks must be appropriately installed for the visually impaired.

The use of gradients (cross-slopes) and level differences should be appropriately designed on sidewalks, so they do not obstruct the use by the elderly and disabled. On narrow and mount-up type sidewalks, grades are formed on the sidewalk surface. Consideration is also given to forming semi-flat sidewalks with lower mount-up height. The surface material on sidewalks is selected to prevent the elderly and disabled from falling or slipping.

Where pedestrians must move vertically or walk for long distances, measures such as elevators or moving sidewalks at grade separation facilities, places for pedestrians to stop and rest, extended walk signal lights zones are used. This enables the elderly and disabled a comfortable walk without tiring. Additionally, traffic signs that are easily understood are also needed for the elderly and disabled so they will not lose their way.

The first matter to be dealt with on sidewalks is the width. They must be wide enough for the elderly and disabled to use them and this width must be continuous over the entire length of a sidewalk. Ways to do this is by widening sidewalks and creating pedestrian space by using road space on old roads whose traffic patterns have changed as s result of the construction of a bypass. Other ways to expand the effective width of a sidewalk are to use roadside areas and move on private road structures.

A wide sidewalk is effective even where parts of it are lowered or sloped at the entrances to driveways on private roadside lots. On a mount-up sidewalk, the sidewalk must be lowered or provided with transition sections at intersections with side streets or where vehicles cross the sidewalk to private lots. The transition section of a wide sidewalk may be slightly graded to leave a wide flat area easily negotiated by a wheelchair user.

Some narrow mount-up sidewalks appear wavy as a result of the repeated lowering of the sidewalk or modifications to allow vehicles to cross it. Widening sidewalks is a basic approach, but semi-flat sidewalks are another possibility. On a semi-flat sidewalk, which is a sidewalk with a mount-up height of about 5 cm, it is possible to reduce the quantity of vertical motion of pedestrians. This also allows the visually impaired pedestrians to distinguish the sidewalk and vehicle lane easily by clearly indicating the boundary between them with curbstones.

Barrier free measures are necessary for pedestrians who have to cross roads to reach their destinations. Crossing arterial roads and other wide roads is a problem faced by the elderly and disabled. Pedestrians using crossing zones must be assisted with this task by extending the green light period to handle the vehicle traffic and by installing islands on medians. Grade separation facilities are easier to use if they are equipped with elevators or escalators. Another way to assist pedestrians moving vertically is to use grade separation facilities by linking them to roadside buildings so pedestrians can use the elevators in the buildings.

5.3 U.S. Activities Relating to Persons with Disabilities John, Fegan, Bicycle and Pedestrian Program Manager, OST

Mr. Fegan began by stating that the US Department of Transportation is responsible for providing technical assistance on facilities for pedestrians, including pedestrians with disabilities. The Federal legislation, the Americans with Disabilities Act (ADA), was originally intended for buildings and building sites. The challenge is to determine how to make public rights-of-way, such as sidewalks, pathways, and trails, usable by people with disabilities. These disabilities may be cognitive, visual, or mobility limiting.

Street crossings are particularly challenging, Mr. Fegan noted, for the visually impaired. Issues to be addressed by this community include locating the button to activate pedestrian signals, determining when it is safe to cross, and having the proper directional orientation. Some people with disabilities may not have the physical strength to press pedestrian signal actuation buttons. Wheelchair users must be provided with usable curb ramps and travel paths throughout a community. These curb ramps must be detectable by the visually impaired so they know they are leaving the sidewalk and entering the street.

Mr. Fegan stated that a new two-part technical report is being developed. Part 1 is finished; it reviews the applicable legislation, the needs of persons with disabilities, and the state of the practice in providing transportation facilities. Part 2 of the report will document the best practices found throughout the United States. The FHWA will continue working with other organizations to develop guidelines and standards for making the pedestrian transportation environment usable by people with disabilities.

5.4 U.S. Activities Relating to Persons with Disabilities Lois Thibault, U.S. Access Board, Department of Justice

Ms. Thibault began by stating that the U.S. Access Board issues the guidelines for Accessibility in Public Rights-of-Way. TEA-21 does not address accessibility specifically.

Access standards for sidewalks and streetways have existed since the early 1960s. Dimensions were recommended for sidewalk width, cross slope, curb cut ramps and vertical grades. The Access Board is working on issuing guidance on the accessibility at roundabouts and traffic circles with the focus on those with poor vision, the elderly and children.

The Access Board is working to develop performance standards for portable communication devices for people with visual impairments. They are working with manufacturers in the U.S. and Japan to develop a common platform. However, there is currently a controversy among the U.S. blind community about the conveyance of information in audible vs. imprinted format. Some communication issues also arose about emergency call boxes that are accessible to the deaf and the hard of hearing.
Another area of concern for the visually impaired, older and disabled pedestrians are under- and over-passes.

In the U.S., outdoor elevators and escalators are not typically used with overpasses and underpasses. Instead, ramps and stairways are typically used to access overpasses and underpasses. In general, pedestrians do not like to use overpasses and underpasses because of the perceived longer time required to used them. Overpasses and underpasses are especially problematic for older and disabled pedestrians. In the case of the visually impaired, they have a difficult time locating the facilities. Planners need to take into account that it takes more time for older and disabled pedestrians to use these facilities. New guidelines for overpasses and underpasses will be more stringent to accommodate the visually impaired.

The publication *Public Manual for Successful Sidewalk Design*, provides guideance on how to design an accessible outdoor environment. The Access Board has formed the Federal Advisory Committee to establish new standards for sidewalks and street crossings.

5.5 Elderly Pedestrians

Workshop: Highway Infrastructure Solutions to Solve Older Driver and Pedestrian Problems
Elizabeth Alicandri, FHWA

Ms. Alicandri began by stating that older persons have difficulty judging motion, regardless of speed. As the population ages, the diminished visual capabilities and consequences for driving performance increase. This includes reduced acuity, reduced contrast sensitivity and visual field, restricted area of visual attention, increased sensitivity to glare, decreased adaptation to dark, and decreased motion sensitivity.

There are ways, she continued, to design and implement operational countermeasures to accommodate the decline in visual acuity. This can be accomplished with bigger and brighter traffic signs and larger legends with more contrast and advance warnings of sight-restricted locations.

The elderly have difficulty with divided attention, which results in a slower reaction time. Physical changes also inhibit mobility. Aging is accompanied by reduced strength, flexibility, and range of motion in the arms, shoulders, legs, knees and feet, along with the head/neck and upper torso.

The FHWA has a variety of products, based on the *Older Driver Highway Design Handbook*, that provide information on countermeasures that can be implemented to improve the safety and mobility of older drivers and pedestrians and all road users.

In summary, the percentage of older drivers in the traffic stream is increasing rapidly. Older driver mobility and safety can be improved through changes in the highway system. Accommodating needs and capabilities of older drivers can help all drivers. Handbooks, Web-based information and workshops are available to help traffic engineers make important decision.

5.6 Elderly Pedestrian Zones
Dr. Marvin Levy, NHTSA

Dr. Levy began by stating that the Research and Evaluation Division of the Office of Research and Traffic Records, NHTSA, conducts research and evaluation studies dealing with human attitudes, behaviors, and failures (motor vehicle crashes). The focus is on drivers, passengers, motorcyclists, bicyclists, and pedestrians and their roles in traffic safety.

The percentage of pedestrian fatalities and injuries for those 65 and over for the years 1988 to 1998 has remained about the same with fatalities around 23 percent (1,168 persons killed in 1998) and injuries around 8 percent (5,000 in 1998). He stated,that a 1998 report of pedestrian fatality rate by age (per 100,000 population) indicated that those aged 65 and older were above the average (average about 2/100,000) rising to 4.77 for those 80 and older. A report for the same year indicated the pedestrian injury rate for persons 65 and older was below the average (of 26/100,000) at about 16 per 100,000 population.

The crashes for younger and older pedestrians by month indicate that the months between November and February are the highest for age 65 and older in the United States. The study of crashes with older pedestrians involving turning vehicles by month of the year identified the hightest rate in the months of October through February when the vehicle was making a left turn.

The field test of a pedestrian safety zone program for older pedestrians was conducted with the purpose of developing, implementing, and evaluating a traffic safety countermeasures program directed at reducing the crashes of older pedestrians. The cities of Phoenix, AZ, and Chicago, IL, were selected as suitable sites to develop and apply a zoning methodology to identify concentrations of crashes involving pedestrians aged 65 and older. Based on coordination with city officials, both behavioral (for instance, messages containing advice on how to cross the street safely) and engineering countermeasures (signs with the meaning of pedestrian signals, and repainted crosswalks) were developed and implemented. The end products were a technical report containing the study approach and findings and a guide for other communities on how to use the zone process to solve their own pedestrian safety problems.

The major findings, conclusions, and products are:

$ Motor vehicle crashes involving older pedestrians are a serious highway problem, especially among fatally injured pedestrians.

$ A behavioral- and engineering-based countermeasures program implemented in a large city was associated with a reduction in crashes (Phoenix).

$ The most substantial impact on crashes occurred in the pedestrian safety zones, the areas of the city where the countermeasure campaign was most intense (Phoenix).

$ The campaign appeared to effect both pedestrians and drivers within the zones (Phoenix). The zoning approach was cost-effective in terms of countermeasure implementation. In Phoenix, program materials (packets placed on doors) were distributed within the zones at less than 10 percent of the cost of distributing the materials to all the homes within the city.

$ A *Zone Guide* was prepared that contains information on how to implement a similar program in other jurisdictions having similar problems.

6.0 TOOLS AND PROGRAMS

6.1 Geographical Information System (GIS) Application for Pedestrian Safety

Davey Warren, FHWA

Mr. Warren stated that the Federal Highway Administration has been working in partnership with the state of North Carolina to develop and apply Geographic Information System (GIS) software tools for better analysis of pedestrian and bicycle safety situations. GIS refers commercial software that is used to display maps and analyze geographic information stored in a spatial database.

The GIS-Based Crash Referencing System builds on a previous project that developed GIS tools to view accident reports, video log, and digital aerial photographs in multiple windows concurrently and edit and correct accident locations by pointing and clicking. This function was provided to handle accidents that were mile posted incorrectly on the accident report or not at all.

A number of safety analysis tools were developed including SPOT analysis which maps and lists accidents within given search radius of intersection or roadway feature. The CLUSTER tool identifies all spots within an area or selected routes that exceed user specified threshold or critical rate. The STRIP analysis evaluates accidents within user specified buffer of designated section of the road.

SLIDING SCALE TOOL identifies segments of road with high crash rates. The user specifies the length of strip and increment distance. If crash rate of any strip exceeds the user-defined threshold, the segment is extended by the incremental distance.

The CORRIDOR ANALYSIS TOOL allows an analysis of all roads within a corridor. A user specified driveable distance from designated route defines the corridor.

The SAFE ROUTE TO SCHOOL APPLICATION was developed to generate the safest and shortest walking routes from a residence to a school and associated directions. The safest route is based on a Hazard Index which is a function of road (number of lanes, sidewalks, parking, etc.) and traffic factors (e.g. speed and, volume). The hazards are combined and multiplied by the exposure time (in minutes) to obtain the safety rating. A similar methodology is used for road crossings except that the type of traffic control (e.g., pedestrian signal, crossing guard) is an added factor. Work is underway to make this application run over the Internet.

The BICYCLE COMPATIBLE ROUTES APPLICATION is similar to the Safe Route to School. The user inputs beginning and ending points, as well as other points of interest to visit. The user receives two different outputs: 1) the best route for the individual trip between user selected points or 2) a color-coded map depicting bicycle compatibility index for all links in study area. This information could be used by highway agencies in developing a network of bicycle friendly paths.

The HIGH PEDESTRIAN CRASH ZONE TOOL uses grid analysis and map algebra to generate a contour map identifying areas with high occurrence of pedestrian crashes. High is a relative term based on crash density (e.g., per square km).

6.2 Pedestrian and Bicycle Crash Typing Software (PBCAT) Carol Tan Esse, Pedestrian and Bicycle Safety Research Program Manager, FHWA

Ms. Tan Esse began by discussing the Pedestrian and Bicycle Crash Analysis Tool (PBCAT), which is a software product intended to assist State and local bicycle coordinators, planners, and engineers in addressing the pedestrian and bicycle crash problem. The PBCAT accomplishes this by developing and analysing a database containing details associated with crashes between motor vehicles and pedestrians or bicyclists. One of these details is the *crash type*, which describes the pre-crash actions of the parties involved. Ms. Tan Esse noted that after using PBCAT to create a database of pedestrian or bicycle crashes and their associated details, the user can then use PBCAT to produce graphical and tabular reports about the crash problems and to select countermeasures to address the problems identified.

PBCAT is designed with the five following features:

? Ability to quickly determine the crash type through a series of on-screen questions about the crash, crash location, and maneuvers of the parties involved.

? Ability to customize the database in terms of units of measurement, variables, and location referencing as well as import/export data from/to other databases.

? Ability to produce a series of tables and graphs defining the various crash types and other factors associated with the crashes such as age, sex, light conditions, etc.

? Recommended countermeasures linked to specific bicycle and pedestrian crash types and related resource and reference information.

? User-friendly, on-line instructions and help features, including examples, along with a user's manual.

Finally, Ms. Tan Esse noted that PBCAT and its User's Manual (FHWA-RD-99-192) are also available on CD-ROM. There are plans to make PBCAT and its User's Manual available on the Internet.

6.3 Awareness Pedestrian Roadshow
Leverson Boodlal, FHWA

WANTED: Walkable Communities

Mr. Boodlal began by stating that every year approximately 5,300 pedestrian are killed and about 80,000 are injured in incidents with automobiles. Recognizing this, the FHWA joined forces with NHTSA and developed a new pedestrian program called the Pedestrian Safety Roadshow (PSRS).

The purpose of the Roadshow is to assist communities in developing their own approaches to identifying and solving the problems that affect pedestrian safety and walkability. The Roadshow is a 4-hour workshop for community officials (including engineering, planning, enforcement, educators, and health professionals), concerned citizens (such as youth groups andsenior groups), and local business leaders (including builders/developers and insurance concerns).

The PSRS objectives are to increase the awareness of pedestrian safety and walkability concerns, provide participants with information about the elements that make a community safe and walkable, and channel their concern into a plan of action for addressing pedestrian concerns. It is designed for small-to-medium-sized cities, although it is adaptable for larger cities as well.

The PSRS is much more than just safety; it affects health and the environment. It is about Quality of Life issues. It assumes that at least one person in the community believes that pedestrian safety and walkability is enough of a problem to take ACTION and will request a Roadshow. If there is one voice speaking out for pedestrians, the Roadshow can serve as a catalyst for enlisting others to support of the cause. If more widespread recognition of the pedestrian problems exists within the community, then the Roadshow can help transform this awareness of the problem into a commitment to solve it.

This program combines other resources that have been developed to help communities identify and address their pedestrian safety concerns. These resources include:

??*WALK!*, a 12-minute video that addresses pedestrian safety issues.

??*Pedestrian Safety Resource Catalog*, an overview of the process involved in a community pedestrian program.

??An annotated listing of the technical resources available from the Department of Transportation.

??A Local Sponsor's guide.

??A step-by-step guide to hosting a Pedestrian Safety roadshow.

??*Wanted ? Walkable Communities* brochure that describes the Roadshow process.

??The Tool Box, which is being developed, comprising a set of information/documents on pedestrian facilities and community building.

The Pedestrian Resource Catalog, the Local Sponsor's guide, and the brochure are available on the Web at http://www.ota.fhwa.dot.gov/walk. This is a very important step in making a community a safer, more walkable, pedestrian friendly place to LIVE and WORK.

The demand for the Pedestrian Safety Roadshow has been overwhelming. A training workshop was developed to prepare facilitators to go into local communities and present the Roadshow. To date, we have trained 225 facilitators from across the United States.

In conclusion, a preliminary evaluation of local communities that hosted a Roadshow indicated that change is taking place, pedestrian considerations are being integrated into planning and design issues, the environment in these communities is becoming more pedestrian-friendly, the level of awareness is being raised among all audiences, and all disciplines are beginning to work together (for example, engineering, enforcement, planning, and EMS.). Finally, safety issues can and should be tied to health, economic, and other considerations as the needs of the local community are determined. The full impact of this and other activities will be seen over time.

6.4 National Highway Traffic Safety Administration Activities Dr. Maria Vegega, NHTSA

Dr. Vegega's presentation began by reinforcing that the safety of our highways relies on good drivers, well-designed vehicles, and carefully constructed roadways. Additionally, solving the pedestrian crash problem takes a comprehensive, coordinated approach that involves NHTSA and FHWA.

We must also look, however, at human behavior in terms of culture and environment. The United States has long been known as a melting pot with people living in different settings--urban, rural, and representing countries and cultures from all over the world. These differences create challenges as far as developing programs and materials that meet the needs of different audiences.

Dr. Vegega continued, noting that the Secretarial Initiative for Pedestrian and Bicycle Safety is coordinated with other Administrations, with DOT, and the Office of the Secretary. This national effort was developed to promote walking and bicycling as safe, efficient, and healthy ways to travel. By the year 2000, the initiative will reduce by 10 percent the number of injuries and fatalities occurring to bicyclists and pedestrians, and it will double the national percentage of transportation trips (from 7.9 percent to 15.8 percent) made by bicycling and walking.

Partnership for a Walkable America (PWA) was created as a part of the Secretarial Initiative for Pedestrian and Bicycle Safety. The public-private coalition (including NHTSA., FHWA, Centers for Disease Control, National Safety Council, Institute of Transportation Engineers, and others) goals were to make walking safer, increase safe and accessible places for people to walk, and promote the health benefits of walking.

PWA completed the third *National Walk Our Children to School Day* event on October 6, 1999. The first year, two cities participated. This year's event attracted an estimated *350,000,* with 500,000 mayors, governors, city officials, community leaders, children, parents, and other caregivers from all over the country and Canada coming together for a walk to school, This national effort was designed to create community awareness about how walkable our children's routes to school are. Best of all, the program encourages families to spend valuable time together.

PWA members developed a walkability checklist, which allows parents and other caregivers to assess how walkable their neighborhoods are. After walking to school, a park, and a friend's home, the parent and child answer five questions about their walking environment. For example, were streets easy to cross, how pleasant was the walk, how drivers behaved. Immediate and long-range suggested actions were created. The program has even been translated to Spanish.

Dr. Vegega also noted that the pedestrian safety toolkit was available in fall 1999. It supports community-based pedestrian safety programs and contains a video compilation of all pedestrian videos, interactive CD-ROM of pedestrian resources, a user manual that explains how to build an effective pedestrian safety program, sample materials so users can hit the ground running, and a resource manual with NHTSA and FHWA materials.

The Pediatric Action Plan to Prevent Pedestrian Injuries (PAPPI) resulted from the 1998 CDC/NHTSA Child Pedestrian Injury Conference. A draft has been completed and is being reviewed by committee members to discuss innovative ways of preventing childhood pedestrian injuries.

Through a cooperative agreement with the National Association of County and City Health Officials (NACCHO), NHTSA and NACCHO will implement and evaluate NHTSA's Child Safety Program for Hispanic Population within four of NACCHO's sites. NHTSA will also provide support to create a pedestrian safety training program for the Border Health Program. This program, which provides outreach services to health agencies along the border States, has identified pedestrian safety as one of its priority areas,

In conclusion, the Pedestrian/Bicycle Charter Group, which is encompasses representatives from NHTSA and FHWA, was created to develop and implement an intermodal coordinated plan to foster safe pedestrian and bicyclist practices, promote walking and bicycling as alternative modes of transportation, and support ongoing livability initiatives.

6.5 National Highway Traffic Safety Administration Activities Lori Millen

Ms. Millen began by stating that While FHWA looks at engineering-based pedestrian solutions, NHTSA looks at education and changing human behavior in terms of culture and environment.

The United States has long been known as a "melting pot" with people living in different settings

- urban, rural, etc. - and representing countries and cultures from all over the world. And these differences create different challenges as far as developing programs and materials that meet our different audiences needs.

However, since the safety of our highways relies on good drivers, well-designed vehicles and carefully constructed roadways, solving the pedestrian crash problem takes a comprehensive, coordinated approach that involves NHTSA and FHWA.

1. ***Walkability Checklist***

Developed with PWA members, this checklist allows parents and other caregivers to assess how "walkable" their neighborhoods are. Has been adapted to Spanish ***(Tome Nota).***

2. ***Pedestrian Safety 'Toolkit"***

    video compilation of all pedestrian safety videos interactive CD-Rom of pedestrian resources
    user manual which explains how to "build" effective pedestrian safety programs
    sample materials so user can "hit ground running"
    resource manual w/NHTSA & FHWA materials

3. ***Pedestrian Safety Program for Hispanic Populations***

As a way of providing information about the hazards that Hispanic pedestrians face in today's traffic environment and what they can do to reduce them, the three-part *Caminando a Través de los Años* (Walking Thru the Years) program was created. The first two parts - designed for older adults and the parents and caregivers of children - have been completed, and work is just beginning on Part Three that deals with impaired pedestrians.

4. Pedestrian Safety Road Shows - Lessons Learned

Several years ago, we joined with FHWA to create the *Pedestrian Safety Road Shows*. These Road Shows were designed to be four-hour, highly interactive workshops that helped local communities mobilize support for their specific pedestrian safety issues. The Road Shows also helped these communities begin the process of organizing and implementing their own pedestrian safety programs by encouraging partnerships between local law enforcement, safety advocates, state & community leaders, educators, and citizens.

As a way of evaluating the success of the Pedestrian Road Shows, we are currently revisiting the ten sites to examine the results, determine the status of the site's pedestrian safety program, and identify what, if any, technical assistance is necessary for the communities to reach their defined pedestrian safety goals. This information will be reported in a user-friendly guide that also includes: a brief history of the road shows; background and a summary of each road show site's "problem;" the effect of the site's "action plan;" problems/roadblocks and successes; what was learned; what, if any, follow-up technical assistance is necessary; and future plans.

5. Spanish Language Pedestrian Radio Public Service Announcements

NHTSA is currently developing a full audio package that provides Spanish speaking radio listeners with traffic safety information about pedestrian, bicycle, and school bus safety.

6. Proposed Partnership National Boys & Girls Clubs Of America

National Boys & Girls Clubs of America (NBGC) is the largest youth serving organization in the United States. NHTSA currently provides support for their national and regional youth leadership conferences, and initiatives. The "Torch Club Program" designed for kids 6-12, and the "Keystone Youth Clubs" designed for kids 14-18 have expressed an interest in pedestrian/bike education and doing "activities" for National Club Week (April 20-27, 2000).

7. Outreach and Education to Judges

NHTSA is working with its liaison to the judicial community to raise this group's pedestrian safety awareness so that they better understand the importance of enforcing pedestrian, bicycle, and school bus safety laws. Our goal is to create a "movement" similar to that that changed attitudes about drinking and driving, and child safety seat use.

8. *Street Law Project*

The youth participants of this program selected pedestrian and bicycle safety as something that they're concerned about. The group has currently developing activities (peer-to-peer training, planning for National Walk Our Children to School in the year 2000).

9. *Transportation Options for Older Adults*

During the next 30 years, as the "Baby Boomers" approach retirement, there will be a dramatic rise in the number of people who can no longer afford a car, can't drive because of physiological conditions, or choose to walk or bicycle for transportation and fitness. Because many of these older adults will require alternative forms of transportation, large-type program materials will be developed to identify the benefits of walking and bicycling and the associated safety concerns, and other transportation alternatives.

In the future, NHTSA will be looking at:

? Case studies--look at examples of communities that improved pedestrian safety;

document what worked, what did not work and why. Effort to establish and disseminate "best practices."

? Conspicuity--look into what we know and whether new information is available

? Model laws and ordinances will examine what is currently on the books, identify compliance levels, and see whether improvements need to be made.

? Continued support for the Partnership for a Walkable America.

? Research to establish more accurate statistics re: how many people are walking; and how many pedestrians are involved in non-traffic-related crashes.

? New (more effective) methods of material and information dissemination.

? Increasing agency (and therefore public) awareness about the importance of increasing pedestrian safety.

6.6 Japanese Traffic Calming Activities
Susumu Takamiya, PWRI

Mr. Takamiya stated that Japanese community zones are based on the European concept behind the Tempo 30 and Zone 30. A community zone is established to introduce traffic calming measures to a neighborhood. This zone occupies an area from 25 to 100 hectares. In order to encourage residents to walk and stop to talk with their neighbors, promote children to play, and enable people to interact with one another safely and comfortably. Within a community zone, traffic restrictions are enforced along with speed reduction measures such as speed humps and chokers on community roads, and on shared vehicle pedestrian roads. Road administrators and the police work together to introduce these measures. This requires exchanging views and coordinating with residents of the neighborhood that is designated a community zone. He noted that the goal is to start the formation of community zones in 450 neighborhoods in Japan by the end of 2002.

Problems facing residential neighborhoods include:

?? declining traffic safety (for example, occurrence of traffic accidents),
?? reduced comfort while walking,
?? a lessened quality of residential life (traffic pollution),
?? aging population,
?? appearance of neighborhoods, and
?? community disruption.

To resolve the problems, community zones are planned and implemented by eliminating through traffic, controlling traffic speed, optimizing road surface parking, increasing measures designed to accommodate elderly and disabled people, promoting bicyclist and environmental and scenic programs, and encouraging resident participation in the reconstruction/revitalization of the community.

The formation of a community zone is conducted to meet study objectives at each step in this process. This includes:

?? specifying problems and establishing the improvement concept,
?? setting the boundaries of the community zone,
?? drawing up the proposed plan, adopting the proposed plan,
?? implementing the plan,
?? evaluating the completed plan, and
?? revising the plan or feedback.

Road administrators, the police, resident participation, and concerned organizations all have roles in implementing traffic calming. It is essential all parties participate and coordinate with each other.

Traffic regulation includes speed restrictions, such as wide area enforcement of 30-km/h limit, prohibiting large trucks, instituting one-way traffic, prohibiting parking, and improving signal timing at intersections. Vehicle speed reduction measures include speed humps, uneven pavement surfaces, chokers, crank, slalom, midblock cul-de-sacs, parking spaces, and mini-rotaries (intersections). Between 1996 and 1999, 138 districts began to establish community zones. In 1999, 110 districts were in the process of establishing community zones.

The Mitaka City Community Zone was used as a pilot for changes in traffic accidents in community zones. The zone occupies 77 hectares and is the home of approximately 9,400 people in 1995. The zone is predominately residential and includes small-scale side street shops. The community zone was introduced here to deal with through traffic in the morning rush hour. Total accidents fell by half after the zone was completed, indicating that the community zone has reduced the accident rate. By categorizing accident data by transportation mode, the breakdown indicates that although accidents involving multiple motor vehicles declined sharply, the rate of decline of accidents involving bicycles was lower, which shows that the percentage of total accidents involving a cyclist actually rose.

Establishing community zones has just begun, and a number of shortcomings with this approach remain to be resolved. The measures of effectiveness for the basic community zone include various effects such as altering through traffic, changing traffic speed, and revitalizing communities. Methods for measuring all these effects must be studied in order to quantitatively assess the effectiveness of community zones.

Looking at bicycle crashes, the reduction effects of community zones were small. While this was only one example, and this problem is not necessarily found in every community zone, greater efforts must be made to reduce this type of accident. This includes more public education for cyclists to increase their awareness. Although it is now more convenient to cycle than before ? cyclists must still be very careful.

The selection of districts where community zones are established often depends on the experience of local officials (the road administrator and the police). Future candidate districts should be selected based on accident rates and other quantitative indices. Another method of selection would be to select districts in response to public demands and needs, but also using the initial indices to make the final decision.

The establishment of a community zone must involve an exchange of views and coordination with neighborhood residents. To encourage these activities, there are plans encourage residents' participation, form a consensus among residents, clarify roles, and raise the consciousness of local officials (the road administrator and the police) who play a vital role in the success of the zones.

Mr. Takamiya concluded that while some of the problems remain, the intention is to overcome these problems through continued research and the collection of knowledge from within Japan and overseas. The PWRI also intends to distribute leaflets and review reports on completed measures and to apply the results of these activities to the implementation of effective measures in residential neighborhoods.

6.7 U.S. Experience with Traffic Calming, Types/Effects

Davey Warren, FHWA

Mr. Warren began by stating that traffic calming responds to public concerns about speeding, cut-through traffic, and making our communities safer for residents, pedestrians, and cyclists. As the measures proliferate to include many streets, so does the controversy and motorists complaints. A number of communities now have moratorium on speed humps.

The report, *Traffic Calming, State of the Art Practice*, was prepared in partnership with the Institute of Transportation Engineers. It inlcudes a description of different traffic calming measures used in the United States and also adresses the impacts on speed, volumes, and crashes.

The four basic types of measures are:

?? vertical deflection such as speed humps,

?? horizontal deflections such as traffic circles,

?? narrowing or chokers, and

?? closures, which have fallen out of favor because of controversy and complaints from surrounding streets. Closures are the measure of the last resort.

Two-thirds of the cities and counties reported using one or more of these engineering measures.

The most widely used traffic calming measure is speed humps. The longer speed humps found in parking lots don't result in vehicle damage or loss of control. The original hump design was 4" high and 12 ft long. These humps were imported from Britain and found to be too harsh for American vehicles. There has been a shift to longer 22 ft. humps and lower heights (3 inches / 75mm). The cost of installing these humps is low and they do slow traffic.

Portland, Oregon is testing prefabricated humps made of recycled rubber. This should lead to more uniform profiles and makie street resurfacing easier by simply unbolting the devise, resurfacing, and reinstalling the device. This hump can be used to test traffic calming layout before permanent installation.

Circles are the most popular horizontal deflection measure. They can usually accommodate cars and buses but not large trucks. Large trucks must turn left in front of the circle, but large trucks are rare on local streets. Although some jurisdictions use STOP signs on minor roads, the best practice is to require yield on all approaches. This helps through traffic and eliminates confusion at the modern roundabouts.

Chokers are one of the popular methods of road narrowing and can be located midblock or at intersections. They are often located at pedestrian crossings to reduce crossing width. Bike riders don't like them because they are forced to merge into the traffic lane.

If the street is wide enough, there can be an opening near the curb for bike riders and drainage.

The central island narrowing provides for landscaping and breaks the view of a wide-open road ? which is conducive to vehicles speeding. It provides a refuge for pedestrians crossing halfway, waiting for a break in the traffic, and then crossing the remaining half. Center islands are even more pedestrian-friendly when combined with crosswalks and divided to provide a crossing entirely at street level.

The current design trend is toward combined measures, which are raised crosswalks with a choker, speed table with center-island, center-island with neck-down, and center-island with chokers. The trends shift from volume control and street closures to speed controls with humps from 12 feet to 22 feet hump and from 4-inch height to 3-inch height. There is also a move away from painting narrow lanes to physical narrowing, and deflection is a plan to treat more than one street and not too large an area.

Safety impacts of traffic calming after adjusting for traffic diversion found that crashes decreased 27 percent ? but volumes also deceased. The crash rates, which adjust for the reduced traffic, declined only 4 percent (not statistically significant). For a comprehensive review of the safety impacts of traffic calming, it is important to examine a wide area, including streets with and without traffic calming. As an example, Portland observed a 40 percent reduction in crashes on streets with humps and circles, however, accident rates declined only 4 percent. This illustrates the importance of controlling the traffic diversion impacts.

In conclusion, Mr. Warren noted that agency concerns were to review case law regarding liability, for which there is none. Another concern, and one of the biggest, is the 3-5 second increase in emergency response time per hump and circle for fire and rescue vehicles. The police favor the humps because they reduce the speed of the vehicles. As long as the location of the hump is posted, there are no problems with maintenance or snow plowing. At this point there has been no involvement with transit, trash, and school bus officials.

6.8 Research PedSmart: ITS Applications for Pedestrians Carol Tan Esse, FHWA

Ms. Tan Esse began by stating that to date, the development and application of Intelligent Transportation System (ITS) technologies has primarily focused on motor vehicle safety and mobility. Recent developments in hardware and other technologies, however, offer the potential for improving pedestrian safety and access by addressing specific problems associated with crossing the street. Properly installed and operated, the application of these devices can enhance the traveling environment.

One of the keys to improving the pedestrian environment through the use of ITS technologies is making the public and those responsible for employing such devices aware of the capabilities and requirements for using such technology.
Pedestrians experience various problems to which ITS technologies can be applied. The areas described in PedSmart include:

- Increased motorist awareness.
- Feedback to the waiting pedestrian.
- Feedback to the crossing pedestrian.
- Pedestrian detection.
- Visual impairment issues.

In conclusion, there are a variety of ITS technologies currently in use to improve pedestrian mobility and access and to enhance pedestrian safety by addressing the problem areas cited above. Ms. Tan Esse noted that specific devices discussed in PedSmart include microwave and infrared detectors, animated eyes display, countdown signal, flashing in-pavement lighting, illuminated pushbuttons, talking signs, and audible signals.

The FHWA's PedSmart Web site (**www.walkinginfo.org/pedsmart**) describes the technologies currently in use, links to manufacturers, installation locations, and other resources. PedSmart will be available on CD-ROM in spring 2000.

6.9 Geometric Design & Traffic Control Devices
Charles Zegeer, University of North Carolina, Highway Safety Research Center

Mr. Zegeer began by stating that available pedestrian safety research shows increased risks to young children and older adults as they cross streets. Children are overrepresented in terms of crashes per population, while older adults are at greater risk to die in pedestrian collisions when compared to other age groups. Many U.S. streets and highways are not adequately designed for pedestrians.

A study was conducted to compare pedestrian crash risks of marked vs. unmarked crosswalks at uncontrolled (i.e. no Stop sign or traffic signal) locations. Based on data from 2,000 locations in 20 U.S. cities, no difference was found in pedestrian crash risks between marked and unmarked crosswalks on two-lane roads and lower volume roads ($\leq$ 10,000 ADT) multi-lane roads. On higher-volume multi-lane roads, having marked crosswalks increases pedestrian crash risk, and are not recommended without other geometric improvements and/or the addition of traffic and pedestrian signals. Having raised medians was associated with reduced pedestrian crash risk. Older pedestrian had an increased crash risk compared to other age groups in crossing streets based on crashes and crossing exposure.

Recommendations were developed for installing sidewlaks on new roads and also along existing streets and highways. These guidelines are based on resarch involving crashes to pedestrians walking along roadways.

Mr. Zegeer discussed various traditional pedestrian facilities, including traffic and pedestrian signals, grade-separated crossings, medians, and pedestrian crossings.

Evaluation results were presented for such innovative measures such as automatic pedestrian detectors, traffic calming measures, innovative pedestiran signals, and other devices. A *Pedestrian Facilities User Guide: Designing for Safety and Access* is being developed for engineers and planners

6.10 Recent Results of Japanese Pedestrian Research
Susumu Takamiya, PWRI

Mr. Takamiya presented a detailed analysis of representative traffic accidents. The analysis focused on pedestrians, studying factors relevant to the planning of traffic safety measures. The categories used for this analysis were accidents that occur while a pedestrian is (1) in an intersection crossing zone, (2) crossing a road section in other ways, and (3) accidents involving elderly pedestrians.

Crashes at intersections and on road sections account for a large percentage of pedestrian crashes. Most of those at intersections are classified as occurring “while crossing in a pedestrian crossing”; most of those on road sections occur “while crossing in other ways”. The frequency of accidents involving people 65 and older in Japan is rising as a consequence of the aging of the population.

This report was compiled using the accident statistic data collected by the National Police Agency in 1997. This analysis included tabulation performed from three perspectives of “who” (person), “when” (time), and “where and how” (place and accident type). The factors relevant to planning traffic accident safety measures were studied in the hope that results of analysis would propose comprehensive traffic safety. The study was focused on identifying target groups and developing specific countermeasures for those groups.

In 83.5% of the accidents, a pedestrian is crossing in a crossing zone at an intersection occurred on arterial/nonarterial road in urban and in nonurban regions. Data also revealed that the percentage of accidents occurring on arterial roads in urban regions is greater than the percentage of all types of accidents.

In 83.3% of the accidents, pedestrians involved in this accident category did not commit an illegal act. This indicates that even though a pedestrian crossing in a pedestrian crossing zone is not guilty of an illegal act, pedestrians are often involved in accidents because drivers break the law. Analysis also indicates that accidents occur because of a combination of an illegal act by a driver and a pedestrian's lack of care or failure to anticipate danger. Forty percent of pedestrian accidents occurred on right-turn target streets. (In Japan, people drive on the left side. Thus, a right turn in Japan is equivalent to a left turn in the U.S.)

While many accidents on right-turn target streets occur at night or during rain, it is assumed that when drivers turn right, their top priority is watching oncoming traffic, and consequently, pay less attention to pedestrians. At night and during rain, when visibility is particularly poor, drivers are more likely not to detect or overlook pedestrians. Analysis of the occurrence of accidents by direction of the pedestrian movement show that among accidents on right-turn target streets, more occur when a pedestrian is walking from right to left (approaching from behind the driver). The major reasons are that it is difficult for drivers making a right turn to see a pedestrian moving right to left from a position behind the vehicle and that drivers do not notice pedestrians who are not visible through the windshield. About 75 percent of accidents occuring on left-turn target streets involve a pedestrian moving from left to right (approaching from behind the driver), revealing that many accidents occur as a pedestrian moves from a location that drivers cannot see easily.

In conclusion, the pedestrians, drivers, etc., must fully understand the events leading up to traffic accidents in order to avoid them. For example, the first need is for a full consciousness of the presence, behavior, and actions of vehicles and of pedestrians, and the second is appropriate action by foreseeing danger. Approppriate actions by pedestrians for example include allowing themselves plenty of time to cross a road and while they are crossing the road, letting drivers know that they are there (by making sure drivers see them).

Events that lead up to accidents and measures to prevent accidents are learned and cultivated through participation and experience in everyday traffic situations. But it is important to provide places for the training of all road users as has been done in driving schools and through other training courses held in recent years.

Also, road administrators have to take appropriate measures. In particular, they should provide necessary road space or traffic safety facilities accounting for the actions of both pedestrians and motor vehicles. On arterial roads, for example, the space used by vehicles should be separate, and if these measures make it inconvenient for pedestrians to cross these roads, pedestrian crossing zones or grade separation facilities should be constructed as needed. And it must be remembered that if these crossing facilities are not suited to the pedestrian line of motion or to the physical strength of pedestrians, they may encourage pedestrians to cross roads improperly.

7.0 NIGHTTIME SAFETY

7.1 Overview of U.S. Nighttime Crashes

Dr. Sam Tignor, FHWA

Dr. Tignor began by noting that the annual vehicle miles of travel for the in the United States has increased, and with it, crashes are also increasing. A report in the 1997 U.S. Crash Experience revealed the total number of traffic crashes were 6,764,000, with 41,967 fatalities. In comparing the time of day with the death rate, studies indicate that of all the deaths per 100 million vehicle miles in 1997, nighttime crashes were four time higher that the day deaths.

The current problems involve increasing total travel miles, 25 percent of travel is at night, 55 percent of fatalities are at night, 60 percent of the pedestrian fatalities are at night, night visibility needs vary by road type, and there are no minimum standards for retro reflectivity. A NHTSA 1996 report states that driver fatality rates at age 16 are very high; the rate then drops and begins increasing again at age 65 and it continues to grow. The time of day is also considered in this study and the results are the most accidents occur after midnight and before 6 a.m.

There is also the human visual difference in day and night driving. The rod based night vision is inactive. It is more difficult for the eye to adapt to the darkness and the glare, plus contrast and color sensitivity changes at night. There are also the affects of a person's age such as cataracts, yellowing of lens, cognitive deficiencies, muscle slowness, and reduced visual field. The night-associated accident condition was a higher percentage when leaving the road.

Dr. Tignor also said that solutions to the night driving problems are retroreflectivity standard signs and pavement markings and the UV fluorescent technology.

Currently, the retroreflectivity standard material available is not being used. The application usage to address the older drivers needs is for overheads, ground mounted (left and right), and for arterials and urban and rural streets.

The pavement markings are not retroreflectivity standard. This creates problems like poor visibility at night, poor visibility when wet, short life of road paint and especially the older drivers needs.

In conclusion, UV fluorescent technology is in the exploratory research stage. Drivers like the technology because it increases visibility of traffic control devices. And it has the great potential to improve safety.

7.2 Sign and Pavement Retro Reflectivity

Dr. Sam Tignor, FHWA

Dr. Tignor began by stating that Congress required - in addition to MUTCD - a standard retroreflectivity that must be maintained for pavement markings and signs, which apply to all roads open to the public.

There are 88 million signs in the United States and many are different types, mounted differently, have visibility problems, and meet no performance standards. The concerns continue with the pavement markings here. The U.S. has 2 million miles of pavement marking and they are mostly paint, which has seasonal wear, are difficult to see when wet, and meet no performance standards. This of course, gives us multivariable problems of material type, material color, sign location, sign size, legend size, and traffic speed. The environment, glare, complexity, and weather; road, and grade; roadway curvature, and cross section; vehicle headlamps and driver's age and vision compound these.

The primary factors of the technical issues are sign placement, size, and symbol or word; traffic speed; sign management and monitoring; State and local acceptance; the cost of implementation. The research approach is to identify the primary variables, quantify the driver visual differences and available vehicle headlights, and determine detection and legibility distance; develop field measurement equipment; recommend minimum standards; and access the national impact. To determine this, the CARTS model is used to access driver needs, determine legibility needed for MUTCD for signs and application, knowing legibility, and determining retroreflectivity required.
The minimum standards for the States would be replacing 5 percent of signs, and locally, 8 percent. The cost would be $32 million for the States and $144 million for the locals. AASHTO is reviewing the recommendations because of local agencies' opposition. A determination is expected next year.

Conclusions are that there is a discrepancy in what drivers need and what is being provided. The States and municipalities cannot be expected to maintain the required level of R_L for all drives of all ages, and better pavement marking materials desired.

7.3 U.S. Use of Ultraviolet (UV-A) Lamps to Enhance Driver Nighttime Visibility John Arens, FHWA

Study Objective

The objective of these studies were to assess the potential night-time safety improvements possible with the use of auxiliary UV-A headlamps in combination with fluorescent delineation and marking materials. In addition, visibility of pedestrians might be enhanced when illuminated by UV-A headlamps due to the fluorescent characteristics of cotton and synthetic fabrics as well as optical brighteners contained in laundry detergents used for washing clothes.

Completed Studies

Mr. Arens reported on two field evaluations of UV-A headlamps: the first, on the Clara Barton Parkway, MD; the second, performed at Quantico, VA. The topics were delineation and pedestrian visibility, impact of glare from oncoming vehicles, and subjective impressions. A printed version of the Clara Barton report is available (FHWA-RD-97-082); the Quantico Study can be found in FHWAs' TFHRC Web Page Library (http://www.tfhrc.gov - Library - Safety: FHWA-RD-99-074).

For the Clara Baron Study, parked subjects counted skip lines and estimated the visibility distance of the right edge line. They also rated visibility subjectively after dynamic exposure. The number of fluorescent skip lines seen were 9.8 with UV-A and low-beam headlamps, 7.6 with low beam headlamps only. Right edge line visibility with UV-A and low-beam headlamps was 180 meters, with low-beam headlamps only, 144 meters. The subjective ratings for UV-A and low beams was 4.7; with low beams only, 3.2. Ratings were on a scale of 1 to 5, with 1 being the worst, 5 the best.

The safety evaluation at Quantico was an objective measure of delineation and the visibility of pedestrians, joggers, and a bicycle. A 2-second look at various settings was provided using a shutter attached to the cars' windshield in front of the test subject. Roadway delineation and recognition distances were considerably higher when low-beam headlamps were used in combination with UV-A auxiliary lamps than with low-beam headlamps only. Pedestrian and bicycle recognition distances were as much as twice with UV-A and low-beam headlamps than with low-beam headlamps only.

Sixty percent of the participants gave the UV-A headlights an excellent rating, while only eight percent of participants rated the low-bean headlights as excellent.

Field studies summaries show consistent increases of delineation visibility of between 30 and 40 percent, while increases in pedestrian and bicyclist visibility increased between 50 and 150 percent.

Current work at Virginia Tech

The update on the Virginia Tech effort explained the larger scope of this study. It includes considerable analytical work, pilot and extensive field evaluations of up to 100 vehicles. Tests will be conducted on Virginias' "Smart Road" and other sections in Virginia. Working teams have been established responsible for developing an infrastructure, suitable UV-A auxiliary headlights, driver and pedestrian assessments, health issues, and marketing. The analytical approach consists of input of driver's age, headlamp data, and pavement marking material data. The outputs will be marking and road surface luminance, contrast, and visibility distance. The "Smart Road" testing will have independent variables such as types of headlight (low beam, low beam with UV-A), multiple levels and configurations of UV-A, and HID headlamps. The type of pavement markings used will be conventional and fluorescent paint and thermoplastic materials. Ambient conditions tested will be clear, mist, rain, fog, and snow. Large-scale tests are scheduled for 2001-02, and plans are to install fluorescent roadmarkings on about 50 to 80 km of various roadways in Virginia. Additional factors include instrumenting some of the test vehicles with "Black Boxes" to collect records of driver behavior and performance. The field test sites selected are tentatively Afton Mountain,Va, a very fog-prone area, some southern Virginia roads near the VaTech campus, and some roads within the DC metropolitan area.
The infrastructure issues involve paints, thermoplastics, and post-mounted delineations. Additional issues to be investigated are life expectancies of these materials, production costs, and the availability of vendors to supply needed material for testing and further development.

The market approach is to identify stakeholders and their concerns, build consensus within stakeholder network about potential benefits to UV-A, facilitate joint-strategic planning, and develop a strategic marking plan.

Mr. Arens concluded that the results will be presented with future recommendations, have car company's concerns relative to styling and additional power demands considered, discuss various approaches (HID, UV, IR), address maintenance concerns, and obtain seed money for headlamps development and participation.

7.4 Overhead Signs and Headlights

John Arens, FHWA

Study Objectives

Mr. Arens stated the three objectives of this study which was performed by Kansas State University in Manhattan, KS:

1) Either confirm the use of 3.2 cd/m^2 as a minimum sign legend luminance value for proper sign visibility in a dark rural area with no opposing headlamp glare - or, to develop a more appropriate luminance value

2) Determine headlamp performance as it applies to sign visibility by evaluating the performance of a large number of random vehicles in the field

3) Assess the potential safety impact on traffic safety of signs with insufficient visibility. Mr. Arens limited his presentation to item 2 - the field study.

First Field Study

The first field study consisted of measuring the illumination provided by headlamps of 2,500 random vehicles at seven locations both overhead and at the right shoulder. Measurement distances were 152, 114, and approximately 81 m. Vertical illuminance values, vehicle speed, and license plate data were recorded. The rational for recording the license plate data was to identify the make, model, and model year of each car to determine whether a gradual reduction in headlamp illumination towards overhead sign locations is taking place since sealed-beam headlamps are being replaced with composite/aerodynamic designs producing beam patterns with less upward light.

Because most of the luminous flux from the headlamps falls on the road surface, a large quantity of light is reflected upward toward sign locations and was included in the illuminance measurements at those locations. However, since retroreflective materials return the light to the source where it comes from, light, while measurable at the sign, does not contribute substantially to the signs' luminance. This flaw, or error, was found during data analysis, the data was discarded, and a second field study was performed.

Second Field Study

The second field study was performed with the photometers shielded such that the light reflected from the roadsurface was essentially blocked from reaching the detector surface. This study included 1,500 random vehicles and 50 known vehicles, where the lamp aim was checked and adjusted, the headlamps were cleaned, and lamp voltage was checked. Vertical illuminance values were measured and recorded at six locations: two at the right shoulder, two at the left shoulder, and two overhead. Measurement distances were the same as in the first field study. Vehicle speed was recorded, but the license plate information was not, as available funding for the study was insufficient to reduce the cars' license plate data to identify make, model, and model year. The 50 "known vehicles" were used to serve that purpose.

The findings and results of the field data at a distance of 152 m indicate that signs (white legend), whose luminance exceeded 3.2 cd/m^2 for the 1,500 cars assessed, are as follows:
Type II (white) material: right shoulder: ~ 90%; left shoulder: ~ 45%; overhead: ~10%.
Type III (white) material: right shoulder: > 99%; left shoulder: > 90%; overhead: ~ 50%.

Using Type III signing materials (Hi-Intensity), we expect to obtain the 3.2 cd/m^2 luminance value suggested as a minimum for legend sign visibility and legibility. Many overhead signs in the U.S. are retroreflective and depend on a small amount of light from headlamps to be visible. With the gradual shift from sealed-beam to composite headlamps, and the trend toward a harmonized beam pattern (sharper cutoff above the horizontal), the continuous utility of many signs, primarily overhead signs and left shoulder mounted signs, is of deep concern to the Federal Highway Administration and many State Departments of Transportation.

There are indications that GTB will incorporate a somewhat less severe cutoff above the horizontal than currently used in Europe for a harmonized beam proposal. If that can be accomplished, we expect to have sufficient sign visibility and legibility with Type III material in most locations. Some specific cases and locations, however, will require the use of microprismatic materials to achieve sufficient sign visibility and legibility.

7.5 Japanese Studies on Traffic Safety Countermeasures in Nighttime and UV Lighting Kazuhiko Ando, PWRI

Mr. Ando began by stating that while nighttime traffic crashes account for 30 percent of the total number of traffic accidents; the fatalities resulting from nighttime traffic accident account for 55 percent of the total number of accident fatalities. As this suggests, nighttime traffic crashes in Japan tend to be fatal and, in comparison with daytime traffic crashes, include larger percentages of person-to-vehicle accidents and vehicle-alone crashes.

Speeding is considered to be a major cause of nighttime traffic accidents. Despite poorer visibility, drivers are more likely to exceed the speed limit at nighttime, possibly due to reduced to traffic volumes. Accordingly, studies consider road lighting, traffic signs, delineation devices, and road markings as facilities that can improve nighttime traffic safety.

An investigation was conducted of the state of the practice of guides sign installation at 96 road administration organizations which control the guide signs. The results indicated that retroreflective signs accounted for approximately 50 percent, externally illuminated signs for approximately 30 percent, and internally illuminated for approximately 20 percent of the guide signs installed along the national expressways. Along national highways, in general, retroreflective signs accounted for more than 90 percent of the guide signs installed, and there were very few organizations that had installed externally illuminated signs or internally illuminated signs.

The results of a road user awareness questionnaire indicated that approximately 60 percent of road users had experience of finding it difficult to read the guide signs during the nighttime. The road users found it difficult to read the guide signs particularly when driving with low beam or when the surroundings are bright with neon lights or other lighting. This is attributed to the difficulty in making retroreflective signs sufficiently bright when using low beam, and the signs look darker when surroundings are bright. Many road users request that additional lighting be installed to make the signs brighter.

In order to ensure the visibility of guide signs at night, PWRI has been investigating the brightness of signs at nighttime. The main items to be studied include illuminated sign technologies and sign brightness in consideration of the surrounding environment.

New illuminated-sign technologies are being examined, including externally illuminated signs with special projection, black-light externally illuminated signs, internally illuminated (flexible substrate for backlit signs), translucent retroreflective sheeting, light guide backlit signs, and signs illuminated by electro-luminescence panels.

A study of sign brightness includes consideration of ambient environment and the adaptation of luminance threshold and the sense of brightness.

Future issues consist of the illuminated signs with new technology and the LED information display unit.

In conclusion, Mr. Ando said that several studies are being conducted. These include delineation devices, the problems relating to the devices, and the types of delineation devices. Also being studied are the road lighting features, the height, consideration of pedestrians, lighting level in accordance with pavement characteristics, actual state of low elevation lighting and brightness and the experiment of high elevation lighting. Another study is of pedestrian lights, impression evaluation experiment and the relationship between the sense of safety and optically measured values and reflection characteristics of drainage payment. The final study is of safety facilities using near ultraviolet rays, fundamental experiment on visibility of near ultraviolet ray emitting road marking and visibility in fog.

8.0 Future Cooperation

At the conclusion of the workshop, Mr. Trentacoste and Mr. Nakamura met to discuss themes for future cooperation.

The following items were agreed upon:

1. The U.S. and Japan acknowledged that this workshop was valuable and significant.

2. Both delegations agreed that the workshop should be continued and propose the 9th U.S.-Japan Highway Workshop to be held next year.

3. Japan will host the 9th U.S.-Japan Workshop in Japan, in conjunction with Automated Highway System demonstration (Smart Cruise 21) in early December 2000.

4. Both parties will discuss themes for next year's workshop, however initial proposals are expected from the United States.

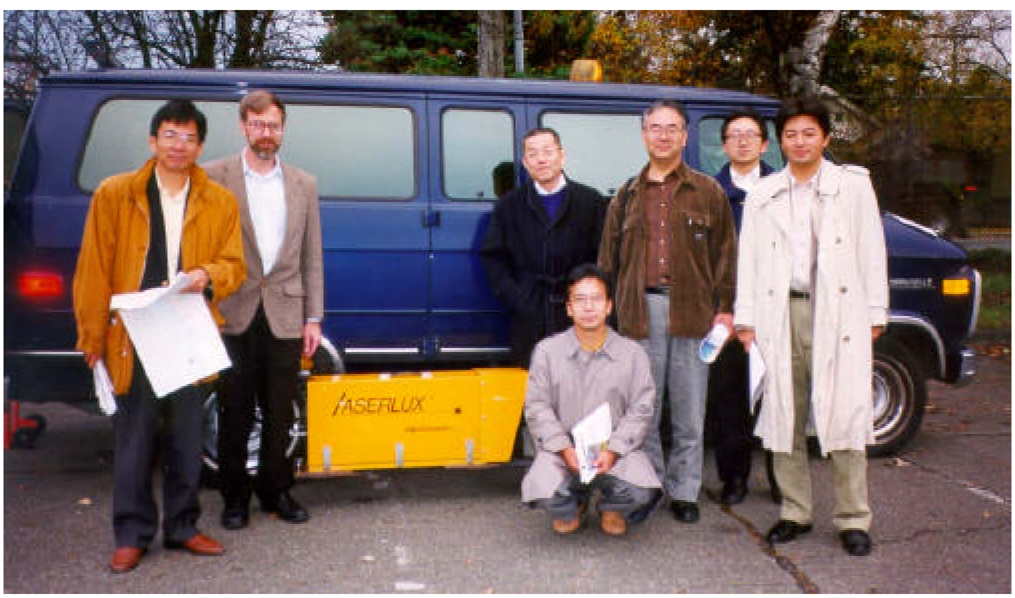
5. As agreed at the 6th Workshop, the heads of both research institutes will discuss past workshops and future cooperation at the 9th Workshop.

9.0 Seattle, Washington Field Trip

9.1 Retroflectivity Van Demonstration

On November 18, the group was accompanied on a demonstration of a retroreflectivity van by Mr. Eldon Jacobson of the Washington State DOT Maintenance Facility.

Jaye explaining retroreflectometer readings to Mr. Ando



Retroreflectivity Van, from l to r: Harumi Kikuchi, Eldon Jacobson, Hiroshi Kasai,(kneeling) Kazuhiko Ando, Makoto Nakamura, Katsuhiko Mitsuhashi, Susumu Takamiya.

9.2 Seattle Pedestrian Facilities Field Trip

Peter Lagerwey of the Transportation Engineering Department Seattle, Washington, guided a tour on November 19, 1999, to the following locations:

Site 1: Second Avenue, a one-way street that was recently rebuilt by the City. We looked at curb bulbs, curb ramps, art in pavement, multi-use buildings, low shrubs and trees, ladder-style crosswalk markings, pedestrian lighting, tight curb radii, and bike racks.

Site 2: Queen Anne Avenue, a two-way street through a neighborhood commercial area. We observed back-in angle parking (each block, on opposite sides of street), stamped "pavers" to mark crosswalk, mixed-use development (retail on ground level, housing on upper levels).

Site 3: On Dexter Avenue, the group saw a two-lane road with bike lanes and center turn lane. Examples of "Road Diets." Dexter was once a four-lane arterial with no bike lanes or center turn lanes. Also looked at sidewalk improvements near and around transit stops.

Site 4: Moved on to Burke-Gilman, a 26-mile trail, most of which is on an abandoned railroad right-of-way. Looked at section near Fremont Bridge.

Site 5: Fremont Troll was used to control the number of automobiles in Seattle.

Site 6: was 8th Avenue, NW, a two-lane road with bike lanes and a median. Another example of "Road Diet."

Site 7: At NW 55th Street, the group observed a set of "chicanes" used to calm traffic on this residential street.

Site 8: At Phinney Avenue North, a two-lane road with bike lanes and a center turn lane, we saw another example of "Road Diets."

Site 9: The group at several traffic circles on 44th Avenue Street used to slow traffic speeds on residential streets.

Site 10: Finally, on North 45th Street, the group observed a pedestrian signal at an intersection of an arterial street. The signal stops arterial street traffic only when a pedestrian pushing the button. There is no signal for residential street, which has stop sign.

9.3 Pedestrian Safety Improvements. Washington State DOT Field Trip

Julie Matlick, Washington State Department of Transportation, guided a tour on November 19, 1999, of the following locations:

Site 11: At Bellevue, NE 8th and Redmond / Bellevue, NE 148, we saw pedestrian mid-block crossings.

This pedestrian crossing features in-pavement flashing crosswalks lights.

Site 12: The new State Route 520 Bike Trail.

Site 13: University Place is a redeveloped urban arterial at Grandview Street Roundabout.

Site 14: Pacific Avenue, in Tacoma, is also a redeveloped urban arterial.

9.4 Field Trip Speakers

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9.5 Visiting Japanese

Mr. Makoto Nakamura
Chief, Road Department
Public Works Research Institute

Mr. Hiroshi Kasai
Director for Parking Policy Coordination, Road Bureau
Ministry of Construction

Mr. Katsuhiko Mitsuhashi
Head, Traffic Safety Division, Road Department
Public Works Research Institute

Mr. Kazuhiko Andou
Senior Researcher, Traffic Safety Division, Road Department
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Mr. Susumu Takamiya
Senior Researcher, Traffic Safety Division, Road Department
Public Works Research Institute

Appendix-A

PEDESTRIAN and NIGHTTIME SAFETY in the U.S. and JAPAN WORKSHOP AGENDA - NOVEMBER 15-19, 1999

Monday - November 15 - Department of Transportation, Nassif Building

OPENING CEREMONY, Administrator's Room -Rm 4200
Introduction
Welcome and Greeting from U.S
Response from Japanese
Introduction of U.S. Attendees
Introduction of Japanese Attendees
Gift Exchange & Photo

OVERVIEW OF SAFETY, Garrett Morgan Room - Rm 3329
Overview of US safety
Dwight Horne, FHWA
Marilena Amoni, NHTSA

New Five-Year Program for Road Technology in Japan
Makoto Nakamura, PWRI

Overview of Japanese Safety
Hiroshi Kasai, MOC

PEDESTRIAN CRASHES
US Pedestrian Cashes
Tamara Broyhill, FHWA

Japanese Pedestrian Crashes
Katsuhiko Mitsuhashi, PWRI

TEA 21 AND PEDESTRIAN PLANNING
U.S. Legislation
John Fegan, FHWA

WELCOME TO TURNER-FAIRBANK, Room T-104
Welcome and Introductions
Dennis Judycki

DISABLED AND ELDERLY PEDESTRIANS

Protecting the Disabled
Protecting the Disabled
Katsuhiko Mitsuhashi, PWRI

Barrier-free Measures
Susumu Takamiya, PWRI

US Activities
Lois Thibault, US Access Board

Elderly Pedestrians
Workshop: Highway Infrastructure Solutions to Solve Older Driver & Pedestrian Problems
Beth Alicandri, FHWA

Elderly Pedestrian Zones
Marvin Levy, NHTSA

TOOLS AND PROGRAMS, T-104
GIS Applications
Geographic Information System (GIS) Application for Pedestrian Safety
Davey Warren, FHWA

PBCAT
Pedestrian and Bicycle Crash Typing Software (PBCAT)
Carol Tan Esse, FHWA

Awareness
Pedestrian Roadshow
Leverson Boodlal, FHWA

National Highway Traffic Safety Administration Activities
Maria Vegega, NHTSA
Lori Millen, NHTSA

BREAK

Traffic Calming
Japanese Traffic Calming Activities (Zone 30)
Susumu Takamiya, PWRI

US Experience with Traffic Calming
Davey Warren, FHWA

Wednesday - November 17 - Turner-Fairbank Highway Research Center

TOOLS AND PROGRAMS (continued)
Research
FHWA Pedestrian Research
Carol Tan Esse, FHWA
Charlie Zegeer, Univiversity of North Carolina

Recent results of Japanese Pedestrian Research
Susumu Takamiya, PWRI

NIGHTTIME CRASHES
Overview of US Nighttime Crashes
Sam Tignor, FHWA

Sign and Pavement Retro Reflectivity
Sam Tignor, FHWA

Overhead Signs and Headlights
John Arens, FHWA

US Use of Ultraviolet (UV) Lamps
John Arens, FHWA

Nighttime Visibility Laboratory Tour
John Arens, FHWA

Japanese Studies on traffic safety countermeasures in nighttime and UV lighting
Kazuhiko Ando, PWRI

Discussion of next Workshop theme and Recap

Closing Statement
Michael Trentacoste

APPENDIX B

Eighth U.S./Japan Workshop on Advanced Technology in Highway Engineering

Washington, D.C.
November 15-19, 1999

<u>List of Participants</u>

Japanese Delegates:

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MOC: Ministry of Construction

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FHWA: Federal Highway Administration
NHTSA: National Highway Traffic Safety Administration
OST: Office of the Secretary of Transportation