

TR NEWS

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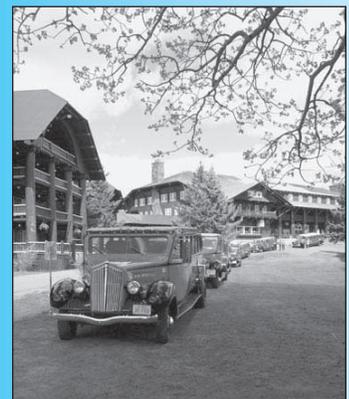
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Cover: Refurbished red buses take riders from park lodges to a scenic tour of Glacier National Park in Montana. Special fleet development is among the transportation innovations now offered on public lands and presented in this issue. (Photograph courtesy of Jean Tabbert.)

features articles on innovative and timely research and development activities in all modes of transportation. Brief news items of interest to the transportation community are also included, along with profiles of transportation professionals, meeting announcements, summaries of new publications, and news of Transportation Research Board activities.

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Park transportation systems must not degrade the place or the visitor's experience of the place, this author observes, defining a new paradigm that calls for a personal transportation system—small, cost- and energy-efficient, nonpolluting, and nonintrusive vehicles available within the park, that employ a variety of ready-to-use technologies.

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A TRB study committee has outlined a conceptual framework for the development of a national freight database, a comprehensive source of timely and reliable data on freight flows. The recommendations cover the organizational and technical steps to implement the program, which would assist decision making about freight at all levels of government and in the private sector.

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The September–October 2004 *TR News* offers a comprehensive look at the need for stakeholder involvement in highway research: what is being done and what could be done to involve local and regional transportation agencies in the research enterprise to identify, undertake, test, and implement innovative transportation technologies.

INTRODUCTION

TRANSPORTATION, & National Parks, Public Lands



Defining the Challenge, Fostering Research and Partnerships

CAROL A. ZIMMERMAN and KATHERINE F. TURNBULL

Most people may be resigned to congested freeways and streets during the daily commute, but no one wants to experience traffic congestion on visits to national parks, wildlife refuges, recreation areas, and other public lands. This issue of *TR News* highlights approaches to address transportation problems in these scenic and historic protected areas.

Park roads, railroads, touring coaches, boats, horses, and hiking trails have played important roles in the development of national parks and public lands. These means and modes continue to serve visitors to and within parks and support the visitor experience. Transportation, national parks, and public lands are intrinsically linked.

The National Park System includes 388 sites covering more than 84 million acres and receives 300 million visitors annually. The National Wildlife Refuge System attracts 39 million annual visitors to 570 refuges and wetlands totaling 96 million acres. Even without adding the statistics for the Bureau of Land Management, the Forest Service, and other public lands to these totals, the magnitude of the transportation challenge is evident.

The federal land management agencies, the U.S. Department of Transportation, state governments, communities, foundations, businesses, regional organizations, and other groups are exploring and implementing innovative approaches to transportation issues in national parks and public lands. The accompanying articles, assembled by TRB's Transportation Needs of National Parks and Public Lands Task Force, seek to advance discussion of these issues and the potential solutions.

The task force provides a forum for transportation

issues, research, and outreach activities associated with national parks, wildlife refuges, recreation areas, and other public lands. Task force-sponsored sessions at TRB Annual Meetings have addressed a range of topics, with paper presentations and invited speakers. The number of annual meeting papers in the subject area has increased, producing a more robust body of knowledge. The task force is sponsoring its first workshop, on transportation and the visitor experience, at the 2005 Annual Meeting.

The task force also is developing problem statements for the National Cooperative Highway Research Program (NCHRP), the Transit Cooperative Research Program, and other research sponsors. NCHRP Synthesis 329, *Integrating Tourism and Recreational Travel with Transportation Planning and Project Development*, stemmed from a task force-developed topic. The task force is drafting problem statements on the influence of changing demographics on park transportation needs, multimodal and intermodal approaches to park transportation, transportation in low-volume parks, and quality of service measures for parks and public lands.

The task force will continue to encourage collaborative efforts—such as those presented in the following pages—to examine and address transportation needs in national parks and public lands.

Zimmerman is Chair, TRB Task Force on Transportation Needs for National Parks and Public Lands, and Vice President, Battelle, Washington, D.C. Turnbull is Chair, TRB Policy and Organization Group, and Associate Director, Texas Transportation Institute, College Station.

Transportation Technologies Take to the Parks

Context-Sensitive Innovations Improve Aesthetics,
Communications, and Safety

GARY L. BROWN, MONICA GOURDINE, BRADLEY J. ROBERTS,
ROGER W. SURDAHL, AND J. HEATHER WOLL

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From coast to coast, national parks are successfully deploying innovative, transportation-related technologies through a partnership between the U.S. Department of Transportation's Federal Highway Administration (FHWA) and the U.S. Department of the Interior's National Park Service (NPS).

"The partnership works very well," observes John Gentry, division chief of maintenance and engineering at the NPS Blue Ridge Parkway in North Carolina and Virginia. "It would be tough for my team to maintain and manage 500 miles [805 kilometers] of parkway without the partnership with FHWA. I have park engineers here, but FHWA has the geotech experts, the structural and bridge engineers, and the highway planners and engineers, and we capitalize on their expertise."

For example, after Acadia National Park in Maine implemented several intelligent transportation system (ITS) technologies, overall traffic congestion and vehicle emissions declined, and ridership on the Island Explorer buses increased by 17 percent from 2001 to 2002. When Rocky Mountain National Park in Colorado installed its vehicle access control system, park-pass holders and authorized personnel were able to bypass the gates, so that visitors in turn experienced shorter wait times for entry.

Goals and Responsibilities

Many of the new technology deployments and implementations are funded through the Coordinated Federal Lands Highway Technology Implementation Program, a deployment and sharing program of the FHWA Office of Federal Lands Highway (FLH) and NPS, along with

other federal land management agencies.

Through its three FLH Divisions, FHWA is responsible for engineering safe and environmentally sensitive roadways and bridges at national parks and on other federal lands. The FHWA Office of Research, Development, and Technology (RD&T), located at the Turner-Fairbank Highway Research Center in McLean, Virginia, studies many of the technologies before implementation by the FLH divisions.

The Eastern FLH Division, in Sterling, Virginia; the Central FLH Division, in Lakewood, Colorado; and the Western FLH Division, in Vancouver, Washington, provide transportation engineering services for planning, design, environment, right-of-way, construction, and rehabilitation of roadways and bridges, as well as material testing and quality assurance. The goal is to work in a context-sensitive manner that protects the environment, reduces congestion, improves aesthetics, enhances communications, and bolsters safety. New technologies help achieve that goal.

The mission of NPS is to preserve and protect America's natural resources for the people. Deploying technology to provide better access to natural resources in the safest and most environmentally sustainable ways is a core mission of FLH.

FHWA has been researching and developing technologies and providing engineering services to the national parks since 1926. But never before have so many new technologies been available, through advances, innovations, and new sources of funding.

The technologies and innovations benefit park visitors and park personnel by reducing crowding, congestion, and pollution, and by providing more pleasing corridors. The aesthetics of the parks are enhanced,

and the quality and durability of roads, bridges, and other infrastructure are improved. The following are highlights of key technologies that the FLH divisions have deployed or plan to deploy in national parks.

Electronic Enhancements

ITS technologies, common in urban areas, are making their way into the national parks. ITS applies computers, electronics, navigational aids, and communications devices to provide real-time information to motorists and transportation decision makers, to decrease congestion and pollution and to increase safety. The Office of RD&T is involved in researching, testing, and fine-tuning these technologies.

To manage roadway capacity, advanced traveler information systems (ATIS) direct travelers to park events, less-congested park entrances, and parking areas. Other ITS approaches use Global Positioning System (GPS) technology to monitor the locations of buses and to predict arrival times at bus stops, keeping visitors informed.

FLH has deployed ITS technologies at several parks, including Acadia National Park, Glacier National Park in Montana, Mount Rainier National

Park in Washington, Rocky Mountain National Park, Bryce Canyon National Park in Utah, Cumberland Gap National Historical Park in Kentucky, and Gulf Islands National Seashore in Florida and Mississippi.

Acadia National Park deploys a variety of ITS technologies, including the Island Explorer Operational Enhancement System, which permits two-way voice communications and equips the environmentally clean, propane-powered Island Explorer buses with automatic vehicle location.

In Glacier National Park, FLH completed an ITS architecture report on the Going-to-the-Sun Road in December 2003, and a deployment plan will be in place soon. The plan is expected to focus on ATIS but also will address ways to mitigate and facilitate the road's rehabilitation. The ITS deployment plan for Mount Rainier National Park will offer strategies to reduce traffic and parking congestion and to mitigate the impact of the upcoming construction at the Jackson Visitor Center in Paradise.

To reduce vehicle congestion at the Beaver Meadows Entrance Station in Rocky Mountain National Park, a fourth entrance lane was added for frequent users such as rangers, vendors, maintenance workers,



PHOTO: JOHN BANDURSKI, GULF ISLANDS NATIONAL SEASHORE

Variable message sign on an access road, Gulf Islands National Seashore, informs motorists about road closures and other travel information.



PHOTO: ROGER SURDATH, FHWA-FLHD

Vehicle Access Control System (*foreground*) reduced congestion at entrance station to Rocky Mountain National Park, Colorado.



PHOTO: FRANK CORNADO/FHWA/ETHIO

New variable message sign undergoes testing after installation in Great Smoky Mountains National Park, Tennessee.

emergency equipment drivers, and Park Pass holders; FLH installed a vehicle access system at the lane's gate.

"Taking these users out of the normal tourist queue has reduced congestion at the entrance station, enhanced air quality with fewer idling vehicles, and improved the initial visitor experience with less frustration due to wait times," says Renee Sigel, quality coordinator and a former transportation planner at the Central FLH Division. The entrance gate, activated by loop detectors, transponders, or card readers, eliminates the need for a park ranger to collect fees and speeds up access to the park.

Bryce Canyon National Park has installed a dedicated access lane with a fast-pass electronic access-control system for authorized vehicles and shuttle buses. Cumberland Gap National Historical Park has put up variable message signs to allow the tunnel operator to communicate with motorists; the operator can override AM and FM radio signals to broadcast priority messages to drivers. At Gulf Islands National Seashore, portable variable message signs assist in traffic management during special events by alerting motorists on the mainland that the park cannot accommodate additional vehicles.

Other ITS technologies in use include traffic monitoring stations, road weather information systems, highway advisory radio via short-distance transmitters along roadways, and Internet websites that provide real-time information to motorists and park personnel. As the costs of the technology decline, and the value to the public increases, more ITS will be deployed in national parks.

Grassy Pull-Offs

Green Parking Alternatives is a technology deployed in the Great Smoky Mountains National Park in Tennessee and North Carolina to allow for soil stabilization of temporary parking areas or pull-offs while maintaining grass growth. An FLH safety study identified the need for pull-offs along the road for law enforcement and emergency use. The park, however, did not want to pave these areas, and gravel pull-offs were not desirable for either aesthetics or safety.

"In the past, FLH tried cellular concrete pavers, but the surface area and heat retention characteristics did not allow for adequate grass growth," says Laurin Lineman, Technical Services Engineer at the Eastern FLH Division. "A cellular confinement system, a plastic block system, and a PVC [polyvinyl chloride] pipe system are being evaluated to accommodate vehicular loading and support grass growth so that the best methods can be incorporated."

Customizing Software

For every technology that park visitors can see, many more are unseen. An example is QuickZone, a software developed by the Office of RD&T and deployed by FLH planners, designers, and construction engineers in decision making.

The software estimates traveler delay caused by work zones and allows a more complete assessment of total construction costs. The input data—such as the location of the work zones, the detour routes, the anticipated traffic volume, and the construction dates and times—generate figures for expected traffic delays, maximum queue lengths, costs to motorists, and other economic impacts.

The software can compare the delays and associated costs with different types of construction or phasing schedules. QuickZone also can compute and compare the user costs of road closure options with the projected construction costs.

Although several states have used QuickZone for years, FLH in partnership with the Office of RD&T is developing a customized version. Deployment is planned in the Wind Cave National Park in South Dakota, Zion National Park in Utah, Rocky Mountain National Park, Glacier National Park, Denali National Park and Preserve in Alaska, and Yosemite National Park in California.

Scoping the Roads

FLH's Road Inventory Program (RIP) has a long history of identifying road conditions on the NPS network and estimating the corrective costs for the maintenance of features such as culverts, signs, and guardrails. RIP now is using a state-of-the-art road analysis program that employs GPS, lasers to detect pavement rutting, pavement roughness sensors to collect International Roughness Index data, an integrated gyroscope to track vehicle movement for determining the roll and pitch of roadway surfaces, front-mounted digital cameras for providing a panoramic view of the roadway, and downward-facing cameras to collect images of the pavement.

Another RIP software package can display processed data with synchronized digital video images. NPS officials can view the road inventory data collected from any of the 254 national parks and generate queries to gather data on specific areas of interest.

The software "is a great new technology for us to maintain our road structure," says Gentry. "We as managers will have data on the conditions and features of the road. There are 500 miles of parkway, and I'll have at my fingertips a visual of every square inch of the parkway, from signs to road curvature to slide areas."



PHOTO: JAMES AVENIA, FHWA-FLH/D

Automated Road Analyzer vehicle is equipped with state-of-the-art technology that enables FHWA staff to collect pavement data on the roadway network within the National Park System.

Profiles by Radar

Interferometric synthetic aperture radar (InSAR) monitors vertical ground movement at centimeter-level accuracy. InSAR detects, maps, and measures movement without survey targets or ground-based instruments.

Synthetic aperture radar (SAR) sensors, attached to either a satellite or an airplane, capture radar images of the earth's surface. The SAR interferometry allows the comparison of two images of the same location taken weeks or months apart, so that analysts can determine profiles of the earth's surface.

Using current and historic data sets, FLH applied InSAR at Badlands National Park in South Dakota, where frequent landslide movement complicates roadway maintenance. InSAR expanded the extent of the observation areas and helped in identifying the size of the landslides near access roads and in assessing the relative stability of alternative routes. The technology pinpointed areas of movement that traditional geotechnical monitoring instruments had not previously identified and that were in the vicinity of park improvements.

InSAR can be used to interpret ground movement and can confirm the nature and location of observations. Interagency observers can review InSAR readings conveniently in conjunction with land deformation maps via the Internet. The software does not replace ground-based surveys or geotechnical studies but adds value to conventional site investigations.

The InSAR ground movement technology also has assisted in observations of slope stability. Other applications include corridor planning and long-term monitoring of highways, railways, dams, groundwater and oil extraction, pipelines, urban development, and mine facilities.

Strength and Durability

Innovative technologies that improve the quality and durability of construction are another benefit to parks, visitors, and taxpayers. The Office of RD&T researched high-performance concrete (HPC) before FLH adopted it for bridges in national parks. The concrete mix meets requirements for higher strength and lower permeability.



PHOTO: DANIEL COLLINS, FHWA-FLH/D

Workers place high-performance concrete on a new bridge in a national park.

HPC uses many of the same materials as conventional concrete, but includes admixtures to engineer and enhance strength and durability. On various bridge components, such as decks and prestressed beams, HPC improves safety, increases the service life, reduces future maintenance and replacement, and ultimately reduces costs.

Bridges on the George Washington Memorial Parkway in Washington, D.C., and the Foothills Parkway in Tennessee have used HPC. Many state

DOTs already have made construction with HPC accepted practice.

HPC allows the designer greater flexibility—for example, to reduce the number of beams, increase the span length and beam spacing, and eliminate the need for a special concrete overlay. Construction time may be trimmed significantly with the smaller number of beams and with no concrete overlay. HPC also offers gains in long-term service and reductions in maintenance and replacement.

Guiding Tourists To and Through the Parks

Study Assesses Traveler Information Needs

MATT BURT AND CAROL A. ZIMMERMAN

What information do park visitors and tourists want? How do they want to receive it? When do they want it? How will they use it? A recent study sponsored by the Federal Highway Administration (FHWA) attempts to answer some of these questions.

The crosscutting study examined the impacts of traveler information systems in four locations: Acadia National Park on the coast of Maine; Branson, Missouri; Salt Lake City; and the I-81 Corridor–Shenandoah Valley in Virginia. The study involved an analysis of available data on system use and customer satisfaction, as well as interviews with representatives of the traveler information and tourism communities.

In Acadia, tourism is intense and dominated by the park. The traveler information systems are oriented to helping visitors easily find their way around. The coordination between traveler information and tourism is partly the result of a recent field test of intelligent transportation systems by the U.S. Department of Transportation (DOT) and the National Park Service (NPS). The strategies have enhanced the operations of the free Island Explorer bus service.

The regional traveler information system for the I-81 Corridor–Shenandoah Valley is 511 Virginia, operated by Virginia DOT. The system is atypical in that it integrates an extensive amount of information on tourism destinations with traditional traveler infor-

mation such as traffic and road conditions. Until recently, however, there was little coordination between 511 Virginia and Shenandoah National Park, so the park had a low profile on the system.

The Acadia and Shenandoah experiences suggest that traveler information systems can support the overall visitor information strate-

gies and the traffic management strategies of national parks and their gateway communities. In interviews, nearly all of the tourism stakeholders agreed that traveler information is valuable. Satisfaction levels are generally high among tourist users, and many tourists report that traveler information has an impact on their travel decision making and on the quality of their travel experience.

Nevertheless, the Acadia and Shenandoah site studies indicate that several challenges must be overcome to realize the full potential of traveler information systems.

◆ **Low awareness and use.** Lack of awareness is a problem for most traveler information systems and is a special challenge for systems serving national park visitors and other tourists. Many stakeholders speculate that tourists—who are in a relaxed vacation mode, in an area for a short time, and perhaps resigned to traffic congestion—are less motivated than daily commuters and other frequent local travelers to obtain traveler information. Attracting the attention of tourists is difficult, and tourists who are less motivated to use traveler information will be turned off more easily by any hassle in accessing the information.

◆ **Limited coordination, despite improvements.** The Shenandoah Valley experience shows that even tourist-oriented traveler information systems may not effectively support the visitor and traveler infor-



511 Virginia provides callers with real-time traffic information, travel conditions, and tourism services for Virginia's I-81 Corridor.

Recycling Materials

Technologies such as HPC can reduce the long-term costs of construction and maintenance, but other technologies can reduce costs immediately. Foamed asphalt stabilized base, for example, reuses or reclaims pavement materials such as old asphalt, base materials, and subgrade soil.

Cold water is introduced into a stream of hot asphalt, causing the asphalt to foam and expand. The expanded, foamed asphalt is immediately injected

and mixed with pulverized in situ materials in the mixing drum of a road reclaimer. The reworked material is then relaid, graded, and compacted, resulting in a high-strength stabilized base.

Although foamed asphalt is not a new technique, advances in equipment have introduced improvements in metering and in the design of the expansion chamber. The technology provides cost savings, does not sacrifice pavement performance, and is environment-friendly, with less hauling of materials,

mation objectives of nearby national parks; moreover, the parks may not be taking advantage of available traveler information systems. Increased coordination between traveler information system operators, national parks, and the extensive state, regional, and local tourism promotion community—with its expertise and infrastructure for marketing and information dissemination—is one of the most promising ways to increase the visibility and use of traveler information systems. Coordination among these parties is increasing.

Inspired partly by the vision of 511 as a comprehensive source of nationwide traveler information, many traveler information system operators are including multimodal and other information—for example, about national parks and other tourist attractions. At the same time, national parks are focusing on managing visitation through their own visitor information strategies, as well as through coordination with other traveler information systems.

NPS also is paying greater attention to how parks influence and are influenced by gateway communities. Finally, tourism stakeholders are focusing on outdoor recreation and scenic and historical resources, and are becoming more aware of the parks' transportation-related challenges.

◆ Differing agendas and sensitivities.

National park personnel, the transportation agency operators of traveler information systems, and local tourism stakeholders have some common interests that traveler information systems can advance. However, these groups also have differing sensitivities, as well as differing—sometimes conflicting—objectives.



The Virginia Tech Transportation Institute operates the control room of 511 Virginia.

For example, tourism stakeholders may maintain that information showing full parking lots and jammed streets will deter potential tourists or will route tourists away from businesses that depend on drive-by traffic. Transportation agencies, on the other hand, aim for system efficiency and safety and usually are not sensitive to microscale routing or to the economic development objectives of an area.

These differing perspectives are not show-stopping impediments but must be acknowledged and addressed. Whenever perspectives have clashed, the primary cause has been a lack of coordination and participation by all parties from the earliest stages

of problem definition and project design.

The crosscutting study's final report, prepared by Battelle, is scheduled for completion in August 2004 and will be available through the U.S. DOT Electronic Document Library, www.its.dot.gov/itsweb/welcome.htm. For more information about the study, contact FHWA Task Manager James Pol, telephone 202-366-4374, e-mail james.pol@fhwa.dot.gov.

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PHOTO: KRANIS HASKAY, FHWA-CEHLD

Entrance to the Zion-Mt. Carmel Tunnel, Zion National Park, Utah. Inside the tunnel, FHWA staff use True Reflection Tomography™ to assess the technical and economic feasibility of enlarging the tunnel.



PHOTO: KRANIS HASKAY, FHWA-CEHLD

Investigator uses a title hammer to survey seismic characteristics of Zion-Mt. Carmel Tunnel.

quicker construction time, and less impact on park visitors and wildlife.

With a tight project budget, Canyon de Chelly National Monument in Arizona chose a foamed asphalt stabilized base for pavement with thermal cracks more than 2 inches (5 centimeters) wide. The monument is in a remote location without local material sources; the pavement materials were reclaimed and reused at a relatively modest cost. The Delaware Water Gap National Recreation Area in New Jersey and Pennsylvania also has used foamed asphalt, and plans are to apply the process in Colorado National Monument and in Rocky Mountain National Park.

Michael Voth, pavement engineer at the Central FLH Division, notes that one of the keys for completing a successful project with foamed asphalt stabilization is conducting a thorough field investigation beforehand.

“It is important that the existing materials are compatible with the foamed asphalt process,” he says. “Developing a good specification and having adequate oversight by personnel knowledgeable about the process and requirements during construction are also important.”

Seismic Signals

Constructed in the 1920s, the 1-mile- (1.6 kilometer-) long Zion-Mt. Carmel Tunnel in Zion National Park is not large enough to accommodate two-way, over-

Designing a New Vehicle for National Parks

Low-Floor, Alternative-Fuel Bus in Testing

JOHN SACKLIN

Yellowstone National Park in Wyoming, Montana, and Idaho is working with the Idaho National Engineering and Environmental Laboratory (INEEL) of the U.S. Department of Energy, and with the automotive industry and other private companies to develop a new mid-size bus for use in national parks. The vehicle is a low-floor, 16- to 32-passenger bus that runs on alternative fuels and complies with the Americans with Disabilities Act (ADA). On a low-floor bus, the passenger area is close to the ground, so that steps are not required for entry; an entry ramp can be extended to accommodate passengers in wheelchairs.

The vehicle meets the design and amenity requirements of national parks and will offer park visitors a desirable alternative to the private automobile. The vehicle is designed for year-round use; one model can operate on tracks, like the snow coaches already in use in Yellowstone and Grand Teton national parks.

The genesis for the national park vehicle can be traced to the historic yellow and red buses built by White Motor Company in the 1930s for Yellowstone and Glacier national parks, respectively. With their classic, roll-back canvas roofs, the buses have attracted park visitors for decades. A refurbished fleet is now operating in Glacier National Park.

The new vehicle's chassis and power train match those designed for the medium-duty, community-transit-shuttle-school bus mar-

ket in the United States. Market analysis indicates that a low-emission, fuel-efficient vehicle will have a range of applications in municipal transit and private-sector transportation. The national park vehicle can be developed at a much lower cost as a subset of this market than as a park-specific bus.

The national park bus can incorporate several different chassis. The initial vehicle, with rear-wheel drive and a gross weight of 19,500 pounds, uses a General Motors C4500/5500 chassis. Fuel options include gasoline, diesel or biodiesel, propane, or compressed natural gas.

During the first phase of the vehicle project, scheduled for completion in December 2004, the program partners developed an ADA-compliant, low-floor prototype. The prototype includes features to support tourism in the national parks—such as an enhanced audio system, a roll-back top, video camera with 25-power zoom and image stabilization, a flat-screen monitor, and a DVD player.

The first demonstration vehicle arrived in Yellowstone and Grand Teton in August 2003. That fall, the bus toured additional national parks and other locations around the country, gathering comments from park staff, park partners, and the public.

In late November 2003, the vehicle, modified with rubber tracks for driving over snow, was tested at the track manufacturer's facility in Oregon. The bus operated successfully within Yellowstone from January through March 2004. Information from the tour and the subsequent testing will assist in refining the vehicle's performance and in adjusting the design.

The demonstration vehicle was well received in several locations around the country. Suggestions included reducing the truck-like look of the front end, which also would improve the forward visibility for riders, and improving the passenger amenities. The partners have developed a list of possible revisions, divided into five areas: the minor restyling of the front end to replicate the original historic design more accurately; the major restyling of the transition from the cab to the back of vehicle; interior issues; the design of additional amenities for the vehicle; and the



The yellow bus (above) will provide transportation in Yellowstone National Park this winter.



The bus can be modified with rubber tracks (left) to drive over snow.

design of towing systems that can hitch to a wheel- or ski-based trailer carrying equipment or cargo, or to a trailer with additional seating for passengers. Production of the vehicle will begin later this year.

Partners, funding sources, and major suppliers of components in this National Park Service project include INEEL; the Federal Transit Administration; the U.S. Department of Energy; General Motors Corporation; vehicle consultants ASG Renaissance of Dearborn, Michigan; alternative fuel advisers Ruby Mountain, Inc., of Salt Lake City; vehicle engineering firm Heart International of Grand Blanc, Michigan; Champion Bus Company of Imlay City, Michigan; and Omni Track of LaGrande, Oregon.

The estimated purchase price of the vehicle ranges from \$110,000 to \$180,000, depending on the amenities and on specification of a track system for winter operations.

Websites

Heart International
www.heartinternational.com/
Idaho National Engineering and
Environmental Laboratory
www.inel.gov/

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The entry ramp in the low-floor, new yellow bus extends to accommodate passengers in wheelchairs.

sized vehicle traffic. NPS and FLH are evaluating remedies such as enlarging the tunnel or constructing a parallel tunnel.

“Accurate appraisal of the technical and economic feasibility of these options depends in large part on assessing ground conditions around the existing tunnel and the proposed parallel facility,” notes Khamis Haramy, geotechnical engineer at the Central FLH Division.

FLH conducted the assessment by applying a proprietary seismic reflection–holography technique. The technology analyzes the seismic signals from several source and receiver locations, identifying reflector zones within the rock mass that may correspond to voids, fracture zones, or significant changes in the geologic structure. The survey area included zones with known ground support problems and voids, for verification of the tomography results.

Historic Walls

Glacier National Park’s spectacular Going-to-the-Sun Road is supported and protected by a series of 127 retaining walls and guard walls. Constructed in the early 1920s, the stone masonry walls not only improve safety but also are part of the park’s cultural heritage.

Aging has created an urgent need to ensure the

integrity of the walls, however. Continued deterioration could lead to major and possibly catastrophic failures.

In response, the park partnered with FLH in 1999 to develop a wall management program. A systematic approach to managing the historic walls, the program includes an ongoing condition assessment that requires a detailed inspection of one-third of the walls each year. An electronic management database tracks the inspection records, characterizes the severity and extent of deterioration, and defines costs to support the program.

The program has enabled park personnel to manage and repair the aging wall systems more effectively, to predict deterioration, identify actions to improve conditions, estimate the cost of alternatives, determine least-cost maintenance and rehabilitation strategies, and generate reports and summaries for planning and programming.

“Response has been very positive from Glacier National Park,” says Alan Kilian, geotechnical engineer at Western FLH Division. “The park staff feels that [the program] has helped them proactively manage this cultural heritage while also striving to provide a safe and enjoyable environment for the traveling public and park personnel.”



Stone masonry walls, originally constructed in the 1920s, undergo repair and maintenance at Going-to-the-Sun Road, Glacier National Park, Montana.

According to Kilian, integrating the program into the park's project planning efforts has gone smoothly. Costs have been minor—approximately \$8,000 every other year.

Tapping into Sensors

The primary access road at Denali National Park and Preserve undergoes severe damage during the spring thaws. Predicting when the road could open safely to tourist buses and other vehicles is difficult. The challenge has prompted implementation of a communications system for transmitting road information from remote sites in the park.

The time domain reflectometry (TDR) system places sensors in the roadway that measure the moisture content of the soil. The TDR sensors do not measure temperature but can indicate if the soil is frozen. Ground temperature sensors also have been placed and connected into the communications network.

The TDR and temperature sensors are hardwired to a solar-powered, low-frequency radio transmission array, which uploads real-time data for analysis by the park's roads and trails staff. NPS personnel had required a full day to collect information on road conditions, but now staff can compile the data within minutes.

In the past, Denali staff responsible for long-term ecological monitoring had managed the road with winter condition data from the headquarters office, the only physically accessible area. Now, the TDR radio system and satellite sensors transmit data from several sites throughout the park, and sites are being added to extend the network's capabilities.

The results have enhanced decision making about when to open the park road to buses, concessionaires, and maintenance vehicles without damaging the roadway. The technology helps the Denali roads and trails staff develop efficient plowing schedules and to prepare for the park opening dates. TDR information also aids in setting weight restrictions for park and concessionaire vehicles during the spring thaw, preventing damage that can take as much as 70 percent of the season to heal or repair.

"The technology has strengthened communications among the various user groups, giving them more accurate and timely information to help manage park resources," says Robert Beck, drill coordinator at the Western FLH Division. "This supports not only the general park traveler but also the scientific community working in the park."

In Glacier National Park, the U.S. Geological Survey (USGS) is responsible for avalanche predictions



Time domain reflectometry system in Denali National Park, Alaska, provides improved information about winter road conditions.

to improve safety, especially for the crew that plows and opens the road in the spring. Previously, USGS had guessed about snow conditions in making safety forecasts. Now the TDR weather station at Logan Pass sends data to headquarters several times a day through a low-frequency radio system.

The technology has worked so well that the park plans to expand the number of weather data collection sites and to connect the east side weather station to the radio system. Other scientific groups are considering how to use the established TDR radio systems in these parks for air quality monitoring, animal tracking, and vehicle tracking to mitigate congestion.

Big Picture Overview

Technologies like these are implemented only after research, development, and testing. The process may start with park officials confronting a transportation-related problem and requesting the assistance of FLH. Or FLH itself may identify a problem and develop a solution.

The national park system is decentralized, and each park has unique needs. FLH takes a context-sensitive approach to implementing solutions but also identifies trends, problems, and general themes that may apply to many parks.

FLH makes technological innovations in the many areas related to transportation available to the national parks and other federal entities. An array of specialists—known as “champions” under FLH’s technology program—works with the parks to solve problems, enhance amenities, and implement the technologies. The successful results are evident in the variety of technologies deployed and the benefits gained—especially by visitors, who enjoy a safer and more pleasant stay in the national parks.

Transportation Partnerships in the Parks

Cooperative Initiatives Serve Visitors, Preserve the Environment

KATHERINE F. TURNBULL

The author is Associate Director, Texas Transportation Institute, Texas A&M System, College Station. A member of the TRB Technical Activities Council and Chair of the Policy and Organization Group, she serves on the Transportation Needs for National Parks and Public Lands Task Force, as well as on several standing committees and a project panel.

Exploring national parks and other federal lands is a major pastime for Americans and foreign visitors. From horses to railroads, to open-topped touring coaches, to automobiles, to ferries, to hiking and biking, transportation always has been an integral part of park visits. Congested roadways, overcrowded parking lots, exhaust fumes, and vehicles blocking scenic vistas, however, detract from the park experience.

Visitors to many of the more popular parks this summer have encountered new travel options, with expanded service on shuttle bus systems and ready information about transportation conditions and alternatives. These improvements represent the coordinated efforts of federal land management and transportation agencies, state governments, local communities, foundations, businesses, and other groups. Working together, these organizations are

addressing critical transportation needs, providing options for travelers, and enhancing visitors' experiences, while preserving and protecting the natural features of the parks.

Shuttles in the Parks

Red and yellow touring coaches gained fame serving visitors to many western parks in the 1930s and 1940s. In Montana's Glacier National Park, red "jammer" buses still transport visitors, thanks to the combined efforts of Ford Motor Company, concession operator Glacier Park, Inc., and the National Park Foundation (NPF). In the 1970s, bus service was introduced in Grand Canyon National Park and in a few other parks to address traffic congestion.

The Transportation Equity Act for the 21st Century (TEA-21) requested a comprehensive study of alternative transportation needs in national parks. Five parks hosted transit demonstration projects: Acadia in Maine, Golden Gate and Yosemite in California, Grand Canyon in Arizona, and Zion in Utah. Different service strategies were considered for each.

Implementation of the shuttle bus systems at Acadia and Zion advanced more quickly than those at the three other parks and are in a sixth year of operation. In addition, new shuttle bus systems have been introduced at Rocky Mountain National Park in Colorado, Utah's Bryce Canyon National Park, Fort Clatsop National Park in Oregon, and Virginia's Colonial National Historic Park.

Exploring the Maine Coast

Introduced in 1999, the Island Explorer shuttle bus has become an integral part of the transportation system in Maine's Acadia National Park. The Island Explorer is free and optional, operating during the peak summer season.



Acadia National Park's implementation of intelligent transportation system (ITS) technologies—including Global Positioning System (GPS), automatic vehicle location, and automated passenger counting—helped Island Explorer buses maintain quality service during a period of intense ridership growth. From 1999 to 2002, ridership doubled from 140,931 to 281,142.

In the first year, eight propane-fueled buses operated on six routes, linking hotels and businesses with major park destinations. In response to the popularity of the Island Explorer, a seventh route and nine more buses were added in 2000. Service was extended from Labor Day to mid-October in 2003, and an eighth route was introduced for the 2004 summer season.

As part of a federal Intelligent Transportation Systems (ITS) Field Operational Test, Island Explorer buses are equipped with automatic vehicle location systems, which provide real-time information on the location of the buses. Visitors can check on the status of Island Explorer buses on the Internet and at major stops, and the information is updated every 3 minutes.

Island Explorer ridership grew from 142,000 in 1999 to 340,336 in 2003. Ridership in 2003 represents a 21 percent increase over 2002 totals, primarily attributable to the extension of service into October. The Island Explorer serves visitors and residents, with an average daily ridership of 4,145 passengers during the peak summer months. Annual passenger surveys continue to show strong support.

The Island Explorer is a cooperative effort of the National Park Service (NPS), the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the Maine Department of Transportation, the Mount Desert Island towns, Friends of Acadia, L.L. Bean, regional organizations, local businesses, Downeast Transportation, Inc., and other groups. L.L. Bean was the sole corporate underwriter for the Island Explorer in 2003 and was instrumental in extending the service.



PHOTO: FRANK CORRADO FHWA-FHLD

Island Explorer ITS at Acadia National Park applied a GPS relay to provide real-time arrival and departure times to visitors via electronic displays at bus stops, as well as website postings.

The park entrance fee increased in 2004, with \$10 from every weekly and annual pass allocated to a special account to support the Island Explorer. Acadia is one of the parks approved by federal legislation to collect a transportation fee for the support of public transit services.

Pioneering with Lewis and Clark

The Lewis and Clark Expedition reached the Pacific Ocean in November 1805. Traveling by birch-bark canoes, the expedition established a winter encampment south of the Columbia River. This summer, the Explorer shuttle bus system began transporting visitors to the Fort Clatsop National Memorial at the encampment site.

Planning for the shuttle bus system started in 2001 with concerns that visitors would overwhelm the site's limited parking during the 2003 to 2006



The Explorer buses shuttle passengers from Fort Clatsop, Oregon, to lodging, mass transit, and parking.



Historic Triangle Shuttle connects Colonial Williamsburg to Jamestown and Yorktown, Virginia.

Lewis and Clark Bicentennial celebration. Public workshops, charettes, and meetings with local agencies, organizations, and groups highlighted the planning process.

The Explorer shuttle bus represents the coordinated efforts of NPS, the Sunset Empire Transit District (SETD), FHWA Federal Lands Highway Western Division, the Lewis and Clark Bicentennial in Oregon, the Lewis and Clark Bicentennial Association, local businesses, and other organizations. Initiated during the 2004 summer season, the four Explorer shuttle bus routes link Fort Clatsop with SETD and Pacific Transit routes, Amtrak, park-and-ride lots, local hotels, campgrounds, and other stops.

From June 14 through Labor Day, the parking lot of the Fort Clatsop visitor center is accessible only to the Explorer shuttle buses. Visitors can purchase a time-ticket, which serves as a three-day pass on the shuttle.

Shuttling to the Colonies

The Historic Triangle Shuttle debuted this summer in Virginia at the Colonial National Historic Park sites—Historic Jamestowne, Jamestown Settlement, Yorktown Victory Center, and Yorktown Battlefield—and at Colonial Williamsburg. During the peak summer months, the Historic Triangle Shuttle provides service along Colonial Parkway from the Colonial Williamsburg Visitor Center; one route serves Jamestown and a second route serves Yorktown.

Visitors riding the shuttle can connect with the Jamestown Area Shuttle, also newly introduced, and with the Yorktown Trolley. Rides on the Triangle Shuttle service are free for ticket-holders to any of the four historic sites.

The new seasonal services, initiated as a demon-

stration project, are part of a cooperative agreement between NPS, Colonial Williamsburg, and Williamsburg Area Transport. The Association for the Preservation of Virginia Antiquities, the Jamestown-Yorktown Foundation, and York County are providing additional assistance. The Historic Triangle Shuttle represents a first step in preparations for 2007, the 400th anniversary of the founding of Jamestown.

Other Projects

Taking Off

The North Carolina Department of Transportation (DOT) sponsored free bus service during the 6-day First Flight Centennial Celebration at the Wright Brothers National Memorial in Kill Devil Hills. No public parking was provided at the memorial during the celebration, December 12 through 17, 2003.

A multiagency committee started planning the transportation elements of the celebration 2 years in advance. In addition to shuttle buses, the Centennial Celebration transportation plan addressed traffic management, traffic control, parking for dignitaries, and emergency medical services response.

Five shuttle routes served special park-and-ride lots, lodgings, and designated stops. The department contracted for the use of 140 coaches and 30 smaller buses, including lift-equipped vehicles for individuals with special needs.

Bus-only lanes and other traffic measures helped manage traffic at the memorial. Although rain forced the relocation of one park-and-ride lot during the first days of the celebration, the shuttle bus system worked well, serving 30,000 of the 35,000 visitors during the peak days.

Heart of the Park

A weekend Heart-of-the-Park shuttle bus will travel California's Santa Monica Mountains National Recreation Area starting in November. The demonstration project is a response to needs identified through an extensive visitors survey, follow-up public meetings, and focus groups.

Service will be hourly on four routes. The buses will be equipped to carry mountain bikes, surfboards, and hiking gear.

The routes connect park-and-ride lots with major park destinations, as well as with Los Angeles Metropolitan Transportation Agency routes and other bus services. The shuttle bus will relieve traffic congestion on park roadways and provide residents and visitors with access to park destinations.

Service Enhancements

Seasonal shuttle services operate in the parks at Zion, Yosemite, Bryce, Rocky Mountain, and Cape Cod, and a year-round shuttle bus system serves Grand Canyon. These shuttles have received service enhancements, and ridership continues to grow.

Several park websites are displaying improved transit maps. Developed for NPS by the Volpe National Transportation Systems Center, Cambridge, Massachusetts, the maps satisfy federal guidelines for providing information to individuals with special needs and meet FTA specifications for transit websites.

Urban Park Innovations

National parks, monuments, and historic sites in major metropolitan areas raise special transportation concerns. Many of these parks are in busy downtown areas. Adding 2 to 4 million visitors a year to the already congested transportation systems in Washington, D.C., Boston, Philadelphia, New York, and San Francisco presents unique challenges. Heightened safety and security concerns have closed roads in some areas and added special screening facilities in others.

The institutional arrangements also are complicated, with a multitude of state, regional, and local agencies and authorities responsible for the roadways, public transportation, and parking systems. In part-

nership with these area organizations, urban parks are dealing with the issues in unique and innovative ways.

Ringling the Bell

Considered the birthplace of the nation, Independence National Historic Park occupies 45 acres in downtown Philadelphia, about 20 city blocks. The park includes the Liberty Bell Center, Independence Hall, the National Constitution Center, the Independence Visitors Center, and other historic buildings. Additional historic sites, such as the Betsy Ross House, are located in districts around the park.

The urban location, bisected by busy six- to eight-lane streets, creates unique challenges related to safety, security, traffic congestion, and building maintenance. Approximately 40 percent of the annual 2.9 million visitors arrive by motor coach or school bus, but the buses contribute to traffic congestion and detract from the visitor experience. When the park general management plan was in development in the 1990s, residents of the adjacent neighborhoods voiced concerns about the buses.

The remaking of the mall and the construction of the new Liberty Bell Center, Independence Visitors Center, and the National Constitution Center provided the opportunity to address some of these concerns. The new buildings, wayfinding signs, and other enhancements unify the setting and enhance the visitor experience.



The new transportation center in Philadelphia provides bus parking to relieve traffic congestion at the city's historic sites.

The Independence Transportation Center addresses traffic congestion and motor coach parking. Opened in the summer of 2003, the center includes 11 spaces for motor coaches to drop off and pick up passengers. The center's lot, three spaces on an adjacent street, and five others throughout the historic district are the only authorized places for motor coach loading and unloading in the historic district. The Philadelphia Parking Authority enforces the motor coach restrictions, with violators facing \$250 fines.

A motor coach parking facility also opened in 2003 on a parcel of land acquired during the construction of Interstate 95. The lot includes 40 parking spaces and a drivers' lounge. Motor coach operators can use the facility for \$20 a day or \$30 with overnight parking. Motor coaches can come and go throughout the day.

The Independence Transportation Center and the motor coach parking facility represent the coordinated efforts of NPS, the city of Philadelphia, the Philadelphia Parking Authority, the Independence Visitors Center, the National Constitution Center, and other groups.

Viewing the Golden Gate

The 1,491-acre Presidio military facility in San Francisco was transferred to NPS in 1994. The Presidio is part of the Golden Gate National Recreation Area, the largest urban national park in the world.

Converting a site with some 800 buildings, a research facility, a golf course, a national cemetery, and a variety of recreational and community services in a dense urban environment into a national park is not easy. Congress established the Presidio Trust to lease and manage the site to help meet the requirement for a financially self-sufficient park by 2013. In 1998, the Trust assumed management of the noncoastal areas of the Presidio.



PHOTO: BRENDA THARP

A free shuttle service has operated in the Presidio, a section of the Golden Gate National Recreation Area in San Francisco, since 2001.

PresidiGo

Transportation is a key component of the 1994 General Management Plan Amendment and the 2002 Presidio Trust management plan. The Presidio Trust is developing a transportation system to improve mobility within the park, to increase the use of public transit and of pedestrian and bicycle options, to improve connections with regional transit, and to make travel easier without relying on automobiles. Started in 2001, the PresidiGo Shuttle bus is an integral part of the strategy.

A free shuttle system operated by the Trust, PresidiGo serves two routes 7 days a week. The system carries 5,000 to 7,500 riders per month and provides easy access to locations in the Presidio for visitors, employees, and residents. PresidiGo connects with services provided by San Francisco Municipal Transportation Agency (MUNI); Golden Gate Bridge, Highway, and Transportation District; and other local systems.

A special lunchtime shuttle operates on Tuesdays, providing employees with service to restaurants and stores along Lombard and Chestnut streets. Many stores and restaurants offer a discount to shuttle riders.

Transit Facility

A transit center is in development. The facility will replace a nonhistoric structure adjacent to the post office-bank and the Presidio Fire Department. Designed to complement the historic setting, the facility will include bus bays, passenger waiting areas, public restrooms, restaurant space, and a conference room. The center will serve as a focal point for PresidiGo service. MUNI and other transit providers may serve the center in the future.

The Presidio Trust also operates other services to encourage transit use, carpooling, bicycling, and walking. In addition to the Tuesday lunchtime shuttle, the Trust provides park employers and employees with a guaranteed ride home program, carpool and vanpool matching services, a bicycle-rack program, transit pass sales, and other commuter choice incentives; the Trust also participates in a car-sharing program. Presidio tenants must meet certain transportation demand management requirements.

Replacing a Link

Another transportation issue in the Presidio is the replacement of Doyle Drive, a 1.5-mile road linking the San Francisco Peninsula with the Golden Gate Bridge and Marin County. Constructed in 1936,

Riding with the Jammers

Although the drivers no longer jam the gears going up and down the steep terrain, and although the traffic is heavier, visitors riding the renovated red buses in Montana's Glacier National Park share the same experience as visitors in the 1930s and 1940s. Through the coordinated efforts of the National Park Service, the National Park Foundation (NPF), Ford Motor Company, concessionaire Glacier Park, Inc., and other groups, the 33 historic White Motor Company red buses continue to serve park visitors today.

Introduced in 1936 and 1937, the red buses quickly became a popular way to see Going-to-the-Sun Road and to reach lodges and other destinations in the park. The red buses were removed from service in 1999 because of safety concerns over structural soundness and metal fatigue.

The restoration of the red buses required the collaborative effort of several groups, funding from Ford through the NPF Proud Partners program, and the application of innovative technologies. The red buses received new chassis, propane-gasoline fuel systems, new bodies, new interiors, and environmentally friendly red paint. The renovated red buses returned to Glacier in 2002.



National Park Service and Federal Highway Administration are investigating potential vehicles for shuttle service in Glacier National Park, as a complement to the interpretative tours given by the refurbished red buses (left). Two prototypes include a hybrid electric vehicle (center) and a wheelchair-compliant, propane-fueled bus (right).

The historic vehicles, the dramatic scenery, Going-to-the-Sun Road, and the drivers—or “jammers,” as they are known locally—make a ride on the red buses a unique experience. The renovation has maintained the historic features of the buses, which seat 17 passengers—four per row and one next to the driver. Individual doors allow easy access to each row of seats. Blankets are provided as in the past to ward off the cold.

The canvas top rolls back for an open view of the mountains. The top can be closed quickly in rain and reopened when the sun comes back out.

The scenic beauty of Glacier, of course, is the main attraction. The mountains, lakes, forests, alpine meadows, and waterfalls make the ride unforgettable.

The 50-mile Going-to-the-Sun Road is one of the great alpine roads in the world—an engineering feat, honored as a National Historic Landmark. Opened in 1932, the road crosses the continental divide and links the east and west sides of the park.

Finally, the jammers add a valuable ingredient to the red bus experience. Jammer Joe, this author's driver, is a semiretired farmer from Illinois; he spends his summers in Glacier. He provides his passengers with a mix of history, geology, jokes, and tips on things to see.

The scenic, interpretive red bus tours are operated by Glacier Park, Inc. Adult fares range from \$25 to \$65, depending on the length and location of the tours.

Even if you do not take a trip on the red buses, seeing them in the park adds to the overall visitor experience. Like the park's lake boat tours and Going-to-the-Sun Road, the red buses continue the legacy of Glacier's unique transportation system.



Historic White Motor Company red bus along Going-to-the-Sun Road.

—Katherine Turnbull

Doyle Drive is the major north-south approach of US-101 to the Golden Gate Bridge, carrying 144,000 weekday travelers, including 17,000 via transit.

The San Francisco County Transportation Authority is the lead agency in the Doyle Drive project, in cooperation with California DOT and FHWA. Other local and regional agencies and organizations, including the Presidio Trust, are involved in the interagency working group.

An active public and community involvement process includes a Doyle Drive subcommittee, community workshops, open houses, a website, project information materials, public hearings, and other outreach efforts. A recommended alternative is expected to be available for public review and comment in early 2005.

Other Urban Activities

Activities are also under way at other urban parks, historic sights, and monuments:

- ◆ Weekend ferry service from Manhattan to Jacob Riis Park on the Rockaway Peninsula in Queens, New York, started this summer. Developed, funded, and operated through the coordinated efforts of NPS, NPE, Ford, N.Y. Waterway, and local agencies, the ferry links with a free shuttle bus serving sites in the Gateway National Recreation Area on the peninsula.

- ◆ A study is examining transportation services for the National Mall, memorials, and surrounding parks in Washington, D.C. The contract with Tourmobile, which has been serving visitors to the Mall since 1969, expires in 2007, and the study is exploring alternatives.

Park Scholars

Two unique programs are providing additional resources to address transportation issues in national parks. Both efforts are part of NPE's Proud Partners of America's National Parks program. Ford Motor Company, one of the Proud Partners, is funding both programs.

The National Park Transportation Scholars Program represents the coordinated efforts of Ford, NPE, NPS, and the Eno Transportation Foundation. The program places graduate students and transportation professionals with parks that need the expertise. In its fourth year, the program has supported 28 scholars, who receive a stipend and housing and spend 3 months to 1 year working in a park.

The participating parks and the types of projects that scholars work on are diverse. The parks and the scholars alike benefit from the program—the parks receive the expertise of the scholars, and projects advance at a faster rate; the scholars gain valuable experience, as well as the satisfaction of addressing critical needs of the park (see sidebar, page 21).

The National Parks Transportation Interpreters is the other National Parks Proud Partners program and is sponsored by NPE, NPS, the Student Conservation Association (SCA), and Ford. Started in 2000, the program assigns young adults, recruited through SCA, to the national parks to provide information on travel options. The program has grown each year, both in the number of interpreters and in the number of parks; 40 interpreters are working in 23 parks this summer.

Reauthorization

The Intermodal Surface Transportation Efficiency Act, TEA-21, presidential directives, and interagency agreements established programs and directions for transportation within national parks and public lands during the 1990s. The projects highlighted in this article—the shuttle bus systems, demonstration projects, alternative-fueled vehicles, ITS field operations tests, and other initiatives—are the result of these federal programs and agreements.

Future funding for transportation programs in the parks, as well as for new initiatives, is part of the TEA-21 reauthorization process. The Administration's Safe, Accountable, Flexible, and Efficient Transportation Equity Act (SAFETEA) of 2003; the House of Representatives bill, the Transportation Equity Act: A Legacy for Users (TEA-LU); and the Senate bill, SAFETEA of 2004, contain different funding levels for current programs.

All versions of the reauthorization legislation, however, would continue the transportation partnership concept. The Administration's recommendation includes the National Parks Legacy Grant program. The House bill includes a Transit in the Parks (TRIP) pilot program, and the Senate bill contains a roughly comparable provision addressing alternative transportation in parks and public lands.

Pointers for Success

The shuttle bus systems, ITS projects, and other innovative transportation approaches are providing benefits to park visitors, the environment, and to gateway communities and adjacent neighborhoods. Shuttle bus riders report positive experi-

Scholars Grow in the National Parks

The National Park Transportation Scholars come from diverse backgrounds and disciplines. All share a common interest in helping improve park transportation.

Susan Law received a joint master's degree in civil engineering and city planning from California Polytechnic State University in 2002. She has spent almost 2 years as a scholar in Montana's Glacier National Park. Law has assisted with projects examining alternative fuels, intelligent transportation systems, internal circulating routes, and shuttle services during the rehabilitation of the Going-to-the-Sun Road.

Law's most recent project is the shared red bike program for employees at Glacier. A \$9,000 grant from the Glacier Foundation funded the purchase of 20 bicycles, one industrial tricycle, and the necessary helmets, locks, racks, and horns. Stored at strategic locations in the park, the bicycles provide an alternative to the automobile for short trips by park staff.

"Planning alternative transportation solutions at Glacier has been a challenging and rewarding experience," Law reports. "The scholars program provides a unique opportunity to combine my professional skills in transportation planning and engineering with my personal interest in sustainability to make a positive contribution to the park."

Lucas Cruse received a master's degree in urban and regional planning from the University of Illinois—Champaign in the spring of 2003 and started as a scholar at New Mexico's Pecos National Historic Park that August. The park includes the site of the Civil War Battle of Glorieta Pass.

Cruse is developing a transportation plan for the battlefield, which is divided by a highway. Efforts to address the transportation issues in the battlefield have been under way for some 30 years. Cruse is arranging meetings among the agencies and groups involved, drafting a cooperative agreement for the agencies, and preparing a scope of services for the larger study, which includes alternative plans and public involvement.

"Working in Pecos on the Glorieta Battlefield transportation study has been an interesting and challenging experience," reports Cruse. "Helping advance the considerations of alternatives to the long-standing transportation issues in the area has also been rewarding."

Virginia Smith received a master's degree in city and regional planning from Rutgers University in New Jersey in spring 2004 and started as a scholar in California's Devils Postpile National Monument. She is examining funding options for the mandatory shuttle bus system that has served day visitors for 26 years.

Smith also is exploring the use of more environment-friendly vehicles and is assisting with regional coordination efforts. She will join a transportation consulting firm when she completes her term as a park scholar.

"It is an amazing opportunity to live and work at Devils Postpile," Smith says. "I see the benefits and the issues associated with the shuttle buses on a daily basis. I could not have asked for a better experience right out of graduate school."

Jonathan Upchurch is the newest scholar, starting at Colorado's Mesa Verde National Park this August. Upchurch brings 32 years of experience as an engineer, college professor, and staffer for the U.S. House of Representatives Committee on Transportation and Infrastructure. Active in TRB committees, he serves as chair of the Operations and Maintenance Group of the Technical Activities Council.

"Mesa Verde is facing a number of transportation issues," Upchurch observes. "Working on the comprehensive transportation plan, which includes examining alternative transportation systems, is a challenge."



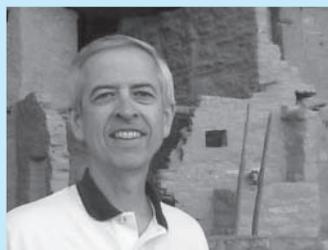
Susan Law



Lucas Cruse



Virginia Smith



Jonathan Upchurch

—Katherine Turnbull

Making Tracks in Wildlife Refuges

SEAN FURNISS

Extending across the international date line from Guam to the Caribbean, across the equator from the Arctic Circle to the South Pacific, and across the continent from the north coast of Alaska to the Florida Keys, the National Wildlife Refuge System includes more than 570 refuges and wetland management districts. This diverse collection of approximately 96 million acres of lands and waters is dedicated to the conservation and management of the fish, wildlife, and plants of the United States.

Refuges provide habitat—food, water, shelter, and space—for more than 200 endangered species and for hundreds of other species of birds, mammals, reptiles, amphibians, fish, and plants. Refuges allow the observation of wildlife in natural settings and offer a variety of recreational activities that vary by location and season—such as hiking, automobile tours, bicycling, photography, wildlife observation, hunting, and fishing.

In 2003, the Refuge System received more than 39 million visitors, and by 2009, more than 50 million are expected annually. Visitation generates more than \$809 million per year to local and regional economies and supports more than 19,000 jobs nationwide. By 2009, visitation is expected to generate more than \$1 billion per year for local and regional economies and to create additional employment.

The Fish and Wildlife Service (FWS) contracted with the Federal Lands Highway (FLH) program to conduct an inventory and condition assessment of the public use road system in refuges and hatcheries. The assessment found that more than 37 percent of FWS roads were in poor to failed condition. In some cases, facility managers had to close roads because project engineers declared the bridges unsafe.

The FWS transportation network includes more than 4,800 miles of roads, 5,000 parking lots, 300 bridges, 2,550 miles of land and water trails, 65 trail bridges, 6 transit systems, and 2 ferry routes. These facilities are on more than 600 units of the National Wildlife Refuge System and National Fish Hatchery System.

More than 100 refuges, wetland management districts, and hatcheries are associated with 58 designated scenic byways in 28 states. In addition, 4 National Scenic Trails, 6 National Historic Trails, and 12 National Recreational Trails are associated with more than 70 refuges, wetland management districts, and hatcheries.



Bike riders take advantage of trails at Chincoteague in Virginia.



Tarpon Bay Tram provides guided tours of J.N. "Ding" Darling in Florida.



Russian River Ferry explores Kenai in Alaska.

The recent alternative transportation needs study by the Federal Highway Administration (FHWA) and Federal Transit Administration, in cooperation with the federal land agencies, identified transit needs at 13 of the 23 refuges examined. Among the transit services in operation are the trams and horse-drawn sleds at five national wildlife refuges: Florida's J.N. "Ding" Darling, Patuxent Research Refuge in Maryland, Chincoteague in Virginia, Wyoming's Elk Refuge, Santa Ana in Texas, and Colorado's Rocky Mountain Arsenal.

An independent concessionaire operates the Russian River Ferry in Alaska's Kenai National Wildlife Refuge. A cable-operated

ferry in Virginia's Presquile National Wildlife Refuge, however, has been closed to address safety and financial concerns.

In 1998, the Transportation Equity Act for the 21st Century established the first federal program to maintain and improve public use roads in the 101-year-old National Wildlife Refuge System. Approximately \$17 million were made available each year from 1999 to 2003 to fund the Refuge Roads Program.

In that time, FWS and FHWA undertook more than 650 improvement projects, worth \$79 million, to improve public roads and parking areas on FWS lands. Projects have varied in scope and size, with FHWA managing most of the larger projects. Projects have included rebuilding entrance roads and tour routes, rehabilitating and improving parking facilities, replacing bridges, installing safety signage, and conducting training sessions on the maintenance of gravel roads.

FWS roads and bridges pose many challenges: severe seasonal road conditions, prolonged submersion of roads, remoteness, limited work periods, wildlife concentrations, and inadequate road maintenance equipment. Another challenge is integrating transportation planning with the efforts of communities and states, most of which are familiar with FWS in its role of reviewing permits during project development but not in its role as a transportation agency.

FWS is working with FLH, America's Byways Resource Center, and the American Recreation Coalition to develop virtual tour routes of six national- and state-designated scenic byways. The public will be able to view highlights of the byways and associated refuges on the Internet. The beta phase of the project is scheduled for September.

The continued improvement of the FWS transportation network will facilitate public access and make driving conditions safer. FWS will conduct customer satisfaction surveys this fall to assess how well the improvements are meeting the needs of visitors.

Website

Fish and Wildlife Service: Public Use Roads, <http://refuges.fws.gov/roads/>

The author is National Coordinator, Refuge Roads Program, U.S. Fish and Wildlife Service, Arlington, Virginia.

ences and support for the services. Improved air quality, reduced noise, and the reappearance of wildlife have been documented in parks with shuttle bus systems. Residents of the neighborhoods surrounding Independence National Park have benefited from a reduction in tour bus traffic. Gateway communities have realized economic benefits from the new transit services.

These recent projects provide models for addressing transportation issues and opportunities in the national parks. There is no one best approach for addressing transportation needs in national parks, but successful park transportation projects have included partnerships; have built incrementally on the unique strengths of each park and on local expertise and funding; have blended old and new modes; and have documented the benefits.

◆ **Partnerships are integral to the success of transportation projects in national parks.** The projects highlighted in this article all involve some combination of federal, state, and local agencies, foundations, businesses, neighborhood groups, and other organizations. Working through the institutional arrangements can be difficult and time consuming, but experience indicates that the investment pays off.

No single agency or group has the resources or the expertise to address all the transportation issues facing national parks. Partnerships will continue to be critical in developing and operating successful transportation systems in the parks.

◆ **Successful projects build on the unique elements associated with each park and on working relationships with other agencies and organizations.** The 6-mile, dead-end roadway in Zion Canyon, for example, works well for the mandatory summer shuttle, but the same approach would not be logical in a park with multiple access points and roadways. Parks typically do not have staff experienced in developing and operating transit services but can take advantage of expertise available from local transit systems, which also can ensure coordination of park transit with regional transit service.

◆ **Successful projects have involved multiple sources of funding.** Funding is always an issue, especially for the operation of shuttle bus systems and other transit alternatives.

Traditional federal, state, and local programs will continue to supply a significant portion of project funds. Corporate and foundation sponsorship, dedicated park transit fees, new federal programs, and other

innovative approaches will play increasingly important roles in funding park transportation projects.

◆ **Introducing new shuttle systems and other transportation improvements in incremental steps is also a hallmark of many successful projects.** The systems build on early successes. Adding routes, expanding service hours, extending operating seasons, and making other improvements are easier with a successful core system.

◆ **Blending new services and technologies with historic park transportation elements is an important goal.** Park roads and bridges, touring coaches, and lodges built by the railroads are important components of the visitor experience in many parks. Successful projects balance new transportation systems with historical and cultural components.

◆ **Successful projects document the benefits.** Although some of these successful projects have not conducted extensive monitoring and evaluation programs, most have documented the benefits derived from new transit services and other transportation projects.

The annual surveys of Island Explorer riders, for example, have identified areas for service improvements, route extensions, and other enhancements. The results show strong support for the system and have been important in securing funding.

Acknowledgments

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Websites

Island Explorer, Acadia National Park
www.exploreacadia.com
The National Park Foundation
www.nationalparks.org
National Park Service
www.nps.gov
Presidio of San Francisco (PresidiGo)
www.presidio.gov
Student Conservation Association
www.theSCA.org
Sunset Empire Transportation District
www.ridethebus.org

Up Close and Personal

FRANZ K. GIMMLER

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NOTE: Point of View presents opinions of contributing authors on transportation issues. The views expressed are not necessarily those of RTC, TRB, or TR News. Readers are encouraged to comment in a letter to the editor on the issues and opinions presented.

Up close and personal—isn't that the way to experience a park? Smell the flowers. Feel the cool spray of the waterfall. Hear the birds singing. Touch the warm rock. Taste the salty sea water. Experience the moment with all the senses—undistracted, undiluted, uninterrupted—closely, personally.

Most park visitors look for but too often miss these special moments in the park. Things get in the way—automobile bodies and windshields, delays on the road, the sounds of engines, the search for parking, and the jostle of crowds.

Visitors and Managers

The park traveler is intent on experiencing a special natural or cultural place. Park travel is an experience, not a trip. The park itself is a unique place, with special values to be protected.

Visitor's Needs

The park visitor's experience is educational and inspirational. Transportation within the park should maxi-

mize observation and interpretation. The visitor should be informed about the features that the park has to offer and the best ways to experience those features.

The visitor should experience the park at his or her own pace, sequence, and duration. The visitor should be allowed to design the park experience to meet unique, exploratory, and spontaneous personal needs.

The visitor may best experience a park feature from one or more stationary locations or in motion. The intrusion of extraneous sights, sounds, and smells should be minimized, as should waits, delays, and other down time.

The visitor should move through the experience transparently, seamlessly, and effortlessly and should not be disturbed or distracted by logistics. Many visitors favor spontaneous exploration. Transportation modes should allow both flexibility and control.

Instruction, information, and interpretation may be communicated on location or in a visitor center. In-motion vehicle information can add to the experience.

When and how visitors share thoughts and feelings is important to the quality of the experience.



Bike riders in Cape Cod, Massachusetts, can bypass car traffic through corrugated tunnels.

The Personal Transportation Alternative in National Parks

Some may prefer to be alone, others with a loved one, and yet others with family. The park transportation system should allow visitors to interact with their companions.

Park Manager's Needs

From a park manager's perspective, a park transportation system should keep the park "unimpaired for future generations," to quote a phrase from the statute establishing the National Park Service. The park transportation system must not rearrange park topography and hydrology, remove plant life, or interfere with animal habitats and movements. The system must not pollute the air or the groundwater, and it should not be physically or visually intrusive. The transportation system should be quiet.

The system should have low capital and operating costs and be easy for park personnel to manage. The infrastructure needed to support the vehicular system, such as maintenance, storage, and fueling facilities, must meet the same conditions. The system must provide good traveler information and interpretation to enhance the visitor experience.

Determining Characteristics

Park transportation systems must not degrade the place or the visitor's experience of the place. These two conditions are critical in determining park transportation alternatives and should guide every design consideration. These two conditions constitute a new paradigm for transportation planners and point to park vehicles with the following characteristics:

- ◆ *Low speed.* Park transportation systems may establish low maximum design speeds. A park traveler's speed does not need to exceed 20 miles per hour (mph), although higher speeds may be required under rare circumstances or in select locations.

Many visitors travel through parks at speeds above 20 mph, impatient to "get there," not realizing that they are there. The park visitor should be able to move slowly and stop occasionally, while looking, listening, and experiencing.

- ◆ *Small size.* Americans visit parks singly or in

small groups of couples and families. A transportation system that takes these small groups where they want to go, when, and in the sequence desired has the potential to attract and serve the majority of park visitors.

- ◆ *Light weight.* Lower design speed reduces the power requirements, as well as acceleration and braking rates, which in turn reduce the bulk and weight of propulsion and braking components. Similarly, lateral and vertical acceleration rates are lowered, which can lighten and simplify the steering and suspension systems. The size and weights of park transportation vehicles and components therefore can be reduced.

- ◆ *Smaller power units.* Not only can smaller gasoline or diesel engines be used in lighter park vehicles, but alternative power sources like fuel cells and hybrid systems that are limited by size and capacity may be feasible. Nonmotorized systems also can be attractive.

- ◆ *Alternative energy sources.* Preventing air and noise pollution is critical. The energy source and the engine or motor are critical to the acceptability of a park transportation system. Because low speed, small size, and light weight reduce the energy requirements, innovative, small propulsion units using alternative energy sources can function in the park environment. Alternative fuels, such as compressed natural gas, are a practical first step toward clean park transportation.

Electric power may be the most desirable form of energy for park transportation. Stationary generating plants for electric power have preferable air quality profiles. Renewable electric energy from the wind, the sun, or geothermal sources is desirable. Nonetheless, many see human-powered, nonmotorized mobility as the ideal.

- ◆ *Clean energy storage.* Batteries and fuel cells are clean technologies that may be used in various hybrid systems, particularly for small vehicles that have controllable cycles of use. Park transportation applications are well suited for the introduction of early model, light-duty, electric or hybrid power systems.

- ◆ *Less intrusive.* With lower speeds and smaller size, the vehicle bulk, profile, and footprint can be reduced. Smaller systems would be less intrusive in the pristine park areas sought out by visitors.



Trail bridges designed for lower loading can be constructed with cost-saving materials.

◆ *Design flexibility.* Lower speed and weight reduce the stresses on the vehicle, so that new non-metallic materials may be used in park vehicles and structures. Lighter materials for the vehicle frame and substructure lead to savings not only in weight but in cost. Plastics and composite materials increase the design flexibility, and noncorrosive materials improve maintainability.

Realizing Savings

Systems with smaller, slower, and lighter vehicles can achieve savings in civil structures such as bridges, tunnels, and roadways or guideways. Road-

ways can be narrower, with thinner concrete and asphalt paving, including permeable crushed-stone surfaces and other nonpavement alternatives.

Light bridging components can suspend a pathway where ground cover conditions are fragile. Bridges can be designed for lower loading. Tunnels with smaller cross sections can employ standard culverts and other multiuse components to reduce costs.

Composite materials can replace conventional structural steel and concrete, to add maintainability and design flexibility and to decrease cost with off-site industrial fabrication. Because the designs can have tighter radii of curvature, whether horizontal or vertical, the park systems can fit comfortably into the topographic and other constraints of parks.

The park service and other public land management agencies traditionally have budgeted for roads but not for building or operating alternative transportation systems. To promote early deployment, park transportation alternatives should have low initial capital and operating costs.

Changing the Approach

The park transportation paradigm embraces technologies that are personal, that serve individuals, couples, and family groups. The technologies should be light and small and therefore less costly and intrusive.

The vehicles should allow for flexible routing and scheduling. They should be energy-efficient and nonpolluting and may include nonmotorized modes. For cost control and user-friendliness, the

Personal Transportation Systems for the Parks

Following are vehicles and systems that are available, attractive, and adaptable for use in a park personal transportation system.

Bicycles

◆ *Comfort bicycle.* Designed for the nonathletic rider, the comfort bicycle is most likely to find use in park systems. The large wheels ride smoothly over rough surfaces.

◆ *Mountain bicycle.* Designed for off-

road use on unpaved paths and trails and on so-called single track, the mountain bike is relatively low to the ground, compact, and maneuverable.

◆ *Electric bicycle.* The electric bicycle enhances all the benefits of nonmotorized cycles, increasing the distance and speed of travel.

◆ *Call-a-Bike.* The German National Railroad operates three Call-a-Bike services with a fleet of more than 3,500

high-tech bicycles. Users arrange by telephone for pick-up or return of the bicycle at any major intersection.

Other Cycles

◆ *Tricycle.* Tricycles are stable at all speeds and suitable for start-and-stop applications and for older persons or persons with disabilities. These features make tricycles suitable for all park visitors.

◆ *Four-wheeled cycle.* Four-wheeled



Mountain bike



Electric bike



Double-recumbent tricycle

system should integrate intelligent transportation system (ITS) components.

The park transportation paradigm implies a new approach for the parks—the personal transportation system (PTS). The PTS consists of small personal vehicles freely available within the park for operation by visitors. Individually, or in small family groups, park visitors can take independent and private self-guided journeys through the park.

A PTS would use existing roads or new trails with special surfaces and inexpensive bridge and tunnel structures. Advances in electric propulsion systems and intelligent fleet management technologies make the PTS feasible and attractive to the parks and to the park visitor.

The PTS system should work well alone or linked with mass transit. Mass transit technologies are based on a need for quick, comfortable travel between trip ends in dense urban areas. Travelers and managers require a combination of safe, low-cost technologies and operating strategies. Those needs often are fulfilled by larger capacity, higher speed, heavier, and costlier driver-operated vehicles and guideways that have environmental consequences less suitable for parks than cities. The short trip durations often result from a short-distance straight line route. Such trip demands, however, are frequently limited in parks and even rarer in refuges, preserves, forests, wilderness areas, and other non-park public lands. In more heavily visited public lands that justify a mass transportation system, a



Neighborhood vehicles can provide a quiet and environment-friendly alternative to traveling by car through national parks.

PTS can be integrated into a multimodal network to serve visitor and park needs.

Alternatives at Hand

The search for technologies that are responsive to the park transportation paradigm need not start from scratch. Transportation visionaries have sought feasible alternatives to the private automobile. Their search has focused on systems that, like the automobile, serve small parties traveling to and from many scattered origins and destinations, on independent and flexible schedules.

Perhaps some of the most important developments have occurred in the search for a better bicycle. In the past two decades, the mountain bike, the comfort bike, the recumbent bike, and a variety of manual, power-assist, and powered bicycles, tricycles, and scooters have debuted (see sidebar, below).

cycles could be an important component in any mixed fleet serving a variety of visitors. The cycles are suited for family tours and provide much of the same service as an automobile, but at substantially less cost to the visitor, the park, and the environment.

Other Vehicles

◆ *Electric scooter.* Scooters have a small profile and footprint, are not difficult to

use, and when equipped with wide tires can navigate most roads and paths.

◆ *Personal electric vehicle (PEV).* The PEV is a practical near-term option for personal transportation systems within parks. Derived from the golf cart, the PEV is a new class of vehicles for use on low-speed private and public roads. The PEV performs much like the golf cart but with greater safety and comfort.

◆ *Segway.* The Segway consists of two

side-by-side wheels controlled by a complex set of gyroscopes and electric motors. Operation is intuitive and safe. Speeds range up to 12 mph. The Segway is in demonstration in several environments, including parks.

◆ *Canoe or kayak.* Many wilderness areas include marine, riverine, and estuarine environments. New, safe, and inexpensive water craft can allow park visitors to explore these environments more closely.



Four-rider quadricycle



Four-wheeled, pedal-powered cycle

Infrastructure

One of the primary advantages of the personal transportation system is its adaptability to nonintrusive, low-cost trails and paths. The systems are compatible, for example, with prefabricated modular bridge structures and tunnels with small cross sections.

A four-wheeled cycle allows families or friends to experience park features together.



The automobile industry and entrepreneurs are introducing smaller, less intrusive vehicle types. Sometimes called “neighborhood vehicles,” the three- and four-wheeled golf carts with electric motors meet many of the criteria for park vehicles.

An upsurge in the popularity of water recreation has stimulated a growing variety of boats suitable for water-based experiences in the parks; vessels include the classic canoe, kayaks, and paddleboats. The trail movement has spawned or adopted new technologies for smaller, lighter, cheaper, and more maintainable bridge and tunnel structures.

Through the efforts of the federal ITS program and of industry, many advanced technologies for highway and transit systems have been developed and demonstrated. Vehicle location, traveler information, vehicle diagnostics, and fleet management systems are all candidates for park transportation systems.

Of particular interest are technologies in development for vehicle sharing, both for cars and bicycles. These systems can handle vehicle reservation, assignment, tracking, and billing. Growing experience with instant rental technologies in Europe and the United States demonstrates the technical and financial feasibility of personal transportation. Such automated or manual, free or fee-based sharing services are important to the operation of a park PTS.

Research to Come

A PTS cannot be purchased off the shelf but involves complexities and uncertainties that need to be understood. The technologies described here and assumed in the PTS model do not challenge the state of the art. Organizing the proposals into a design for a park PTS, however, is another matter.

In particular, visitor preferences and visitor response to PTS vehicles must be documented. Research is needed on the topography, demographics, distances, technologies, and pricing that would lead to successful PTS implementation. A research and demonstration program should be a significant element in the search for alternative transportation systems to serve the national parks and public lands.

Picking Up the Pace

Already park transportation is changing. More than \$6 million—or 11 percent of capital investments in alternative transportation systems—are funding bicycle, pedestrian, and trail facilities. With continuing investment in nonmotorized infrastructure, more can be done with bicycles and other personal transportation devices.

NPS is initiating vehicle demonstrations with two technologies in three parks. Park employees are involved in demonstrations of the Segway—the battery-powered personal transportation device—at Grand Canyon National Park and at National Capital Parks Central in Washington, D.C. In Glacier National Park, “red bikes” are available for staff travel, complementing the park’s well-known red bus services for visitors. The proposed new funding programs in Congress could accelerate the pace of expansion for personal transportation modes in the parks.

Retracing the Vision

The vision presented here involves a delicate balance of group and personal travel modes made available to park visitors. Arriving at a park by car or by mass transportation, visitors would be able to move quietly and quickly on some type of group vehicle between major destinations in the park, including lodgings, visitor centers, trailheads, and other portals.

At portals that provide access to compact park features, pedestrian facilities would be sufficient. At portals that lead into diverse destinations, small vehicles, both motorized and nonmotorized, can be available for visitor use.

Serving solitary travelers, couples, and groups of family and friends, these vehicles would operate along nonintrusive and pedestrian-friendly paths with wayside stops. The vehicles would allow visitors the freedom to reach out into the park on their own. At the same time, the links would decrease congestion in hot spots where parking and other transportation nodes lead to undesirable crowding close to popular park features.

Visitors would experience the park privately, with their loved ones, at their leisure, and on their own schedule and itinerary. Visitors would not be encumbered by automobiles, and the park that they see would not be dominated by roads and parking lots.

With a PTS in the parks, visitors would not have to share with noisy vehicles and large crowds the things they have come to enjoy. In addition, they would enjoy knowing that they are helping to protect the park for future generations.



Parks have run demonstrations of the Segway for possible use by employees.

TRB Meetings 2004

September

- 12–15 North American Conference on Elderly Mobility: Best Practices from Around the World*
Detroit, Michigan
Richard Pain
- 14–17 Structural Materials Technology: Nondestructive Evaluation—Nondestructive Test for Highways and Bridges*
Buffalo, New York
Stephen Maher
- 22–24 9th National Conference on Transportation Planning for Small and Medium-Sized Communities: Tools of the Trade
Colorado Springs, Colorado
Kimberly Fisher
- 26–29 2nd International Conference on Accelerated Pavement Testing*
Minneapolis, Minnesota
Stephen Maher

October

- 19–22 2nd International Conference on Bridge Maintenance, Safety, and Management*
Kyoto, Japan
- 19–24 6th International Conference on Managing Pavements*
Brisbane, Queensland, Australia
Stephen Maher
- 24–27 14th Equipment Management Workshop
Minneapolis, Minnesota
Frank N. Lisle

- 24–27 16th National Rural Public and Intercity Bus Transportation: Celebrating the Silver—Going for the Gold
Roanoke, Virginia
Peter Shaw

November

- 1–2 National Household Travel Survey Conference: Understanding Our Nation's Travel
Washington, D.C.
- 16–17 7th Marine Transportation System Research and Technology Coordination Conference
Washington, D.C.
Joedy Cambridge
- 18–20 Conference for Research on Women's Transportation Issues
Chicago, Illinois
Elaine King, Kimberly Fisher

December

- 1–3 Conference on Managing Travel for Planned Special Events*
New Orleans, Louisiana

2005

January

- 9–13 TRB 84th Annual Meeting
Washington, D.C.
Mark Norman, Linda Karson

April

- 24–28 2005 Transportation Planning Applications Conference
Portland, Oregon

May

- 1–4 10th International American Society of Civil Engineers Conference on Automated People Movers: Moving to Mainstream*
Orlando, Florida
- 11–13 Census Data for Transportation Planning: Preparing for the Future
Irvine, California
- 22–25 National Roundabout Conference
Vail, Colorado
Richard Pain

June

- 20–24 7th International Symposium on Utilization of High-Strength, High-Performance Concrete*
Washington, D.C.
Frederick Hejl
- 27–30 3rd International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*
Rockport, Maine
Richard Pain
- 29–July 1 3rd International Symposium on Highway Geometric Design
Chicago, Illinois

July

- 17–20 6th International Bridge Engineering Conference
Boston, Massachusetts

August

- 13–18 8th International Conference on Concrete Pavements*
Colorado Springs, Colorado

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*TRB is cosponsor of the meeting.

A Concept for a National Freight Data Program

JILL WILSON



With the growth of global markets and international trade, goods travel longer distances than they did 20 years ago. In addition, patterns of goods movement have changed as trade has increased with the Pacific Rim nations and among the North American Free Trade Agreement partners.

Other changes in the business environment—notably the shift from a manufacturing to a service economy, the effects of deregulation, and the advent of freight logistics—also have altered production, distribution, and freight management requirements. The potential for terrorist attacks on the United States via the global transportation logistics network has raised awareness of the need for effective security.

Much of the nation's transportation infrastructure was built to accommodate different patterns of goods movement and passenger travel. As a result, the transportation system today faces challenges in providing the necessary levels of efficiency and reliability in goods movement to ensure international competitiveness for U.S. products and services and to sustain regional and local economies and quality of life.

Because cities are the locations for most major freight nodes—ports, airports, and railheads—and are the origins and destinations for most shipments, freight must compete with passenger traffic for transportation facilities. Limitations of the transportation infrastructure affect the movement of goods and people—for example, road congestion around New York's John F. Kennedy Airport makes access difficult for cars carrying passengers and for trucks carrying freight.

Data for Decision Making

The effectiveness and efficiency of the freight transportation system depend on reliable data to inform a range of decisions at all levels of government and in the private sector. Policy issues affecting freight transportation include

- ◆ Alleviating congestion in suburban and inner-city areas;
- ◆ Developing regulations for safer and more cost-effective approaches to the shipment of hazardous materials; and
- ◆ Enhancing security without impeding the timeliness of goods movements.

The private sector uses freight transportation data to identify underserved and emerging markets, as well as potential improvements in efficiency. Data that help match loads to empty capacity, for example, can allow shippers to increase capacity use at low marginal rates, reducing shipping costs. Because much of the nation's freight transportation infrastructure is privately owned, and private firms carry almost all of the freight, private-sector investments have an important influence on the transportation system as a whole.

Federal agencies and other public- and private-sector entities that monitor or analyze transportation and trade activities on a regional, state, national, or international level collect data on goods movements. These data collections, however, are not coordinated, so that the resulting data sets vary in quality and reliability and provide an incomplete picture of the universe of freight movements.

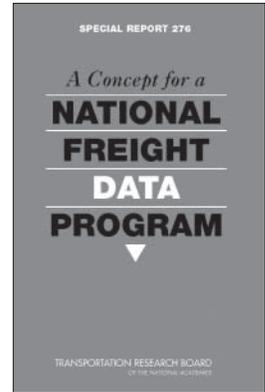
Difficulties in combining data from diverse sources limit the usefulness of the data sets for freight transportation analyses. The disjointed patchwork of freight data sources not only is costly to generate and maintain but does not provide adequate information for decision makers.

Guiding Data Collection

The pressing need for reliable freight transportation data within the context of the changing U.S. economy and business environment was the subject of a November 2001 conference, *Data Needs in the Changing World of Logistics and Freight Transportation*, organized by the New York State Department of Transportation (DOT) and the Transportation Research Board (TRB) in Saratoga Springs, New York. Conference participants called for the development of a strategic freight data business plan to guide data collection.

The Bureau of Transportation Statistics (BTS) of the U.S. DOT asked TRB to conduct a study to recommend a framework for the development of national freight data. The framework was to identify

- ◆ Data requirements for the various users of freight data in the public and private sectors; and



TRB Special Report 276, *A Concept for a National Freight Data Program*, is available from TRB (see Publications Order Form in this issue; to view the book online, go to www.TRB.org/publications/sr/sr276.pdf).

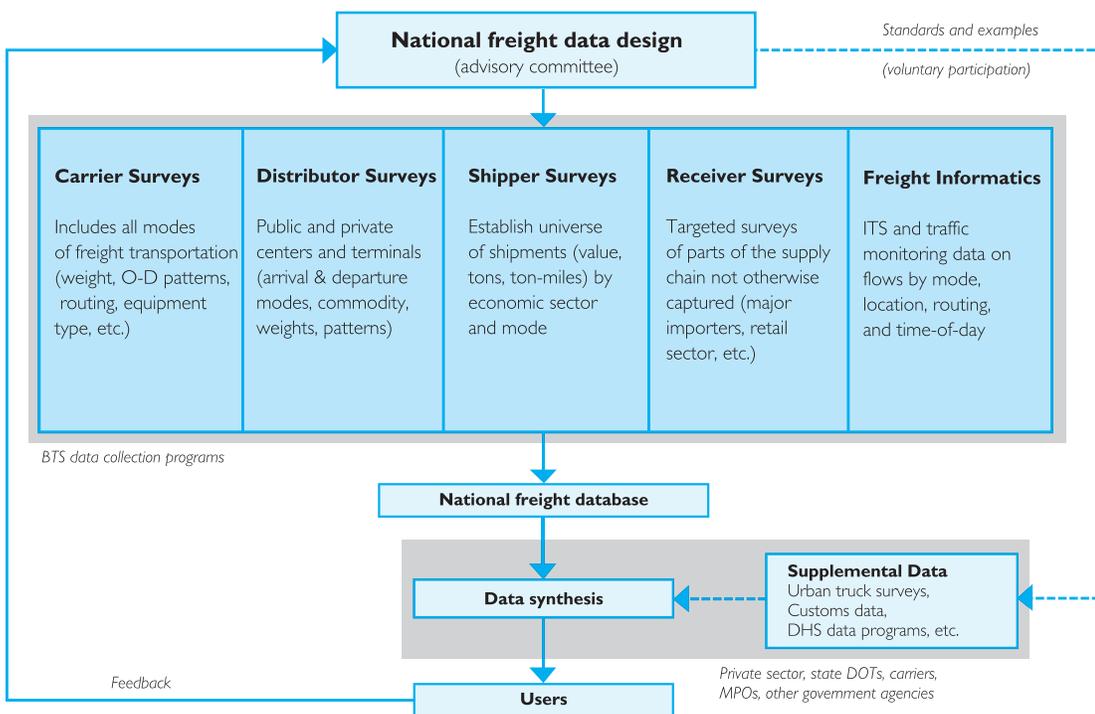


FIGURE 1 Proposed framework of a national freight data program. (O-D = origin–destination; DHS = Department of Homeland Security; MPO = metropolitan planning organization; DOT = department of transportation. Source: Rick Donnelly, PBCConsult, Inc., Albuquerque, New Mexico.)

Committee on Freight Transportation Data: A Framework for Development

Arnim H. Meyburg, Professor, School of Civil and Environmental Engineering, Cornell University, Ithaca, New York, *Chair*

Paul H. Bingham, Principal, Global Insight, Inc., Washington, D.C.

Kenneth D. Boyer, Professor, Department of Economics, Michigan State University, East Lansing

Robert Costello, Chief Economist and Vice President, American Trucking Associations, Alexandria, Virginia

David L. Ganovski, Director of Rail Freight Services, Maryland Department of Transportation, Baltimore

J. Susie Lahsene, Transportation Planning Manager, Port of Portland, Oregon

Catherine T. Lawson, Assistant Professor, Geography and Planning Department, State University of New York at Albany

Robert E. Martínez, Vice President, Marketing Services and International, Norfolk Southern Corporation, Norfolk, Virginia

Robert Tardif, Senior Planner, Ontario Ministry of Transportation, Downsview, Canada

C. Michael Walton, Ernest H. Cockrell Centennial Chair in Engineering, Department of Civil Engineering, University of Texas at Austin

◆ Appropriate roles for federal and state governments and for the private sector in developing and disseminating freight data.

The framework was to be conceptual, not a detailed plan for data collection. The framework would articulate the types of freight data needed by users, as well as the roles of the data providers.

Under the auspices of the National Research Council of the National Academies, TRB convened a 10-member study committee of experts in freight transportation planning and logistics, transportation policy and infrastructure, freight transportation data and modeling, and survey methodology and data collection (see box, above).

Conceptual Framework

TRB Special Report 276, *A Concept for a National Freight Data Program*, presents a framework to guide the development of a national freight database and the related data collection and synthesis activities. This conceptual framework, illustrated schematically in Figure 1, focuses on increasing the links between different data sources and on filling gaps to develop a comprehensive source of timely and reliable data on freight flows.

An advisory committee would oversee the design and implementation of a multifaceted data collection program. The data to populate a national freight database would come from an integrated program of

freight surveys and from a freight informatics initiative that gathers data from electronic data streams—for example, from intelligent transportation systems (ITS) and electronic data interchange.

Data from other sources—such as urban truck surveys—and synthesized data would be supplementary. The resulting databases would be available to the user community, which would provide comments and feedback to inform development of the framework.

The national freight database aims to fulfill the major needs of a variety of users by capturing the important characteristics of freight movements: shipment origin and destination; commodity characteristics, weight, and value; modes of shipment; routing and time of day; and vehicle or vessel type and configuration. Many of these are already available from different sources, but combining the data is a challenge.

Some gaps are difficult to fill except through data synthesis. The most significant gap in modal coverage is in motor carrier flows—a growth area that has not yet been covered well in data collection. Data sets also sparsely cover routing and time of day, which are important for assessing congestion mitigation strategies, for evaluating system capacity, and for ensuring the security of shipments.

Generating Benefits

In assembling a comprehensive picture of the flow of freight, a national freight data framework can present opportunities to enhance the security of goods movement by identifying vulnerabilities. For example, data on routing and time of day for bulk shipments of hazardous materials could be used to identify high-risk scenarios and to initiate appropriate security measures. In the longer term, an improved understanding of normal freight flows would serve as a baseline for identifying anomalies that indicate possible terrorist activity.

The improvements to freight data from the framework approach also could increase the international competitiveness of U.S. products and services by indicating more effective ways to use the nation's transportation system. In addition, the data could help sustain the strengths of regional and local economies and stimulate development through informed decisions that account for freight transportation needs and opportunities.

Although many of the issues in freight transportation are well known, comprehensive high-quality data may be useful in pinpointing underlying causes and in prioritizing policy and investment decisions. The data also may enable research aimed at solving freight transportation problems.



Federal Leadership

No single organization has the resources and expertise to develop and implement a national freight data framework. The interest and cooperation of a range of public- and private-sector organizations will be essential to the success of the framework initiative.

Strong leadership will be needed to coordinate the data collection by diverse entities within the context of an overall strategy. The federal government is uniquely positioned to provide this proactive leadership, because the proposed framework will have a nationwide application; because some of the public benefits are diffuse; and because a systemwide approach is necessary, involving all levels of government and the private sector.

Program Implementation

The report's recommendations offer specific guidance to the U.S. DOT and BTS on the initial organizational and technical steps to implement a national freight data program.

Advisory Committee

A freight data advisory committee of stakeholders and experts would play a key role in guiding program development and implementation. The advisory committee should reflect the spectrum of freight data users and providers and should include representatives of federal, state, and local jurisdictions, as well as a range of private-sector stakeholders.

The private-sector group should include consulting companies, representatives of different modes of transportation (air, marine, pipelines, railroads, and trucking), shippers and receivers, third-party logistics companies, and academic researchers. The committee

also should include an expert in defense logistics, because national defense activities—such as those of the U.S. Army's Surface Deployment and Distribution Command—could benefit from improved freight flow data.

Low-Cost Data

Large amounts of data are required, and some of the information that decision makers need has not been collected before in the United States. Because the costs of surveys are relatively high, implementation of the framework must take advantage of nonsurvey data streams. Low-cost, passive data collection appears promising. For example, ITS roadway surveillance data, generated continuously and in detail for real-time control strategies, also could be used to monitor congestion and to plan intermodal facilities.

Confidentiality

The confidentiality of individual firms must be protected, to avoid a potentially fatal flaw in the framework. Data providers will not participate in framework activities if they perceive any risk of competitors gaining access to commercially confidential information. In encouraging private-sector participation, U.S. DOT and BTS will need to recognize that much of the proprietary data collected for legitimate business planning and investment cannot be converted readily to public-use data.

Continuity

The proposed national freight data program will require a sustained effort and funding over many years and will involve many technical and organizational challenges. Therefore, some form of institutional structure, such as a program office, will be needed to coordinate activities, support the freight data advisory committee, and provide a focal point for the framework initiative.

A program office also would facilitate continuous feedback and refinement of the framework, identifying data collection opportunities, encouraging related research investigations, and ensuring the sustainability of data collection to expand and update the national freight database.

The focus of program activities is likely to shift over time from feasibility studies and concept development to the updating and maintenance that ensure long-term viability. The institutional program structure will need to be flexible to accommodate this evolution.

The author, Senior Program Officer in TRB's Division of Studies and Information Services, served as Study Director for this project.



STONE INTERLAYER PAVEMENT SYSTEM

Extending the Service Life of Low-Volume Roads

MASOOD RASOULIAN

Accelerated pavement testing at the Louisiana Transportation Research Center has confirmed that a stone interlayer design reduces reflection cracking in flexible pavements on low-volume roads.

The author is Senior Pavement Research Engineer, Louisiana Transportation Research Center, Baton Rouge.

Louisiana does not have a natural source of high-quality stone aggregates and must rely on imported material. The costs of stone base courses have increased with the steady rise in transportation costs. For high-volume roads, the Louisiana Department of Transportation and Development (DOTD) typically uses 10 to 12 inches of crushed stone aggregate for base courses. Low-volume roads receive in-place, cement-stabilized soil base courses.

Louisiana has thousands of miles of roads constructed with soil-cement base courses. Shrinkage in the soil-cement layer, however, is a major cause of reflection cracking in the asphalt. The reflection cracking in turn accelerates pavement deterioration and decreases pavement life. Because of the cracking problem with soil-cement bases and the high cost of imported stone, Louisiana DOTD has experimented with stone interlayer pavements.

Problem

Cracking has limited the use of soil-cement mixtures on high-volume roads and has caused performance problems on low-volume roads. Shrinkage cracking usually

extends to the pavement surface in the form of reflection block cracks. These cracks do not seem to affect pavement performance adversely at first, but the negative impact on the service life accelerates as the pavement ages and as the traffic loadings accumulate. A method was needed to minimize reflection cracking in asphaltic pavements.

Solution

Through long-term field research and accelerated pavement testing, the Louisiana Transportation Research Center (LTRC) determined an effective and feasible method to minimize reflection cracking. The stone interlayer pavement system consists of a layer of crushed stone on top of a cement-stabilized base. The tensile stresses developed within the base are absorbed by the stone particles, minimizing reflection cracking.

Field Experience

The first field experiment was conducted in 1991 near Jennings, Louisiana, on LA-97—a rural collector highway with low-volume traffic that includes heavy agricultural haul vehicles. A 4-inch layer of stone was placed over a 6-inch soil-cement base. An 8.5-inch soil-cement base course served as the control section. The surface layer consisted of 3.5 inches of asphalt.

Performance parameters such as pavement roughness, cracking, and deformation were monitored for 10 years. After 4 years, no cracks were visible in the stone interlayer section or the control section. After 10 years, the cracks in the stone interlayer section measured a total of 388 feet, compared with 764 feet of cracking in the soil-cement, control section.

Accelerated Testing

Using an accelerated loading facility (ALF) device, LTRC further evaluated the load-carrying capacity of the stone interlayer pavements. The ALF is a 100-foot long, 55-ton machine that simulates truck loading on pavements (see photograph).

A computer-controlled load trolley repetitively simulates the weight and movement of traffic in one direc-



Accelerated loading facility device at Louisiana Transportation Research Center's Pavement Research Facility, Port Allen.

tion, applying the loads in 10-second cycles. The loads are adjustable from 10,000 to 21,000 pounds. Increasing the loads and running the device 24 hours a day can produce within a few months the equivalent of a pavement loading of many years.

The results of ALF loadings on three pavement sections were compared:

- ◆ A base course of 8.5 inches of limestone;
- ◆ An 8.5-inch-thick, in-place stabilized soil-cement base course; and
- ◆ A stone interlayer base with 4 inches of limestone placed over 6 inches of soil-cement.

All lanes were paved with 3.5 inches of asphalt in two layers.

The results, shown in Figure 1, indicate that at the time of failure, the stone interlayer pavement had sustained nearly 4 times the equivalent single-axle loads of the soil-cement section and 2.5 times more than the stone section. Failure was defined as an average rut depth of 0.75 inches. The accelerated pavement test results verified the superior performance of the stone interlayer design.

Application

In 1999, Louisiana DOTD employed the stone interlayer concept on a second project, a 3.6-mile flexible-pavement reconstruction of a low-volume road. In 2004, the department adopted the stone interlayer base course design as a standard option for pavements in Louisiana. Two major projects are under construction, with three more projects, 5 to 10 miles long, scheduled for letting this year. The performance of these sections will be monitored with data collected through the department's pavement management procedures.

Benefits

For low-volume roads, the initial cost of the stone interlayer pavement is more than that of an in-place soil-cement base course. A flexible pavement with 3.5 inches of asphalt concrete (AC) and a stone interlayer base course of 4 inches of limestone over 8.5 inches of soil-cement costs \$118,000 per lane-mile. A lane-mile of the same pavement with 8.5 inches of stabilized soil-cement costs \$86,000.

A 30-year life-cycle cost analysis was performed using data from the ALF testing. The soil-cement section would require reconstruction at the end of Years 10 and 20, while the stone interlayer section would require a one-time milling and overlay in Year 15. At a 4 percent inflation rate and no salvage value—that is, value after the useful service life—the annual life-cycle cost for the stone interlayer would be \$11,000 per lane-mile, compared with \$15,000 per lane-mile for the soil-cement

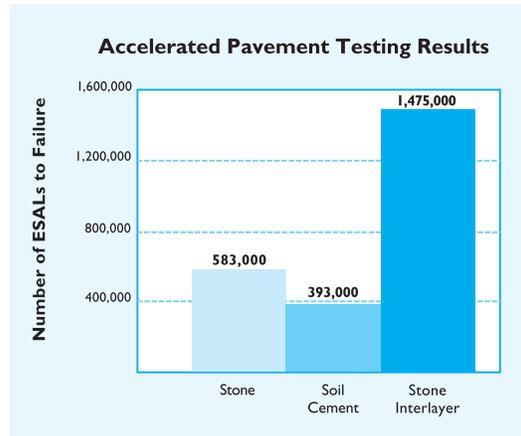


FIGURE 1 Performance of stone interlayer compared with soil-cement and crushed rock.

base course. The stone interlayer construction would reduce the annual cost per lane-mile by 28 percent.

For a high-volume road, a 9-inch-thick AC pavement over a 12-inch stone base course is expected to be comparable in performance to a pavement of the same AC thickness over an interlayer base course of 4 inches of limestone over 8.5 inches of soil-cement. A 30-year life-cycle cost analysis of the two pavement structures indicates an annual cost savings of approximately 40 percent per lane-mile with the stone interlayer design.

The accelerated pavement testing confirms the field evaluation of the superior performance of the stone interlayer design. Although the initial cost of constructing the low-volume pavement structure is higher, the life-cycle cost is lower because the design lasts longer than pavements constructed with conventional methods. The initial and annual maintenance costs of high-volume asphalt pavements built with a stone interlayer base course also are expected to be lower than those of pavements built with conventional base courses.

For more information contact Masood Rasoulian, Senior Pavement Research Engineer, Louisiana Transportation Research Center, 4101 Gourrier Avenue, Baton Rouge, LA 70808 (telephone 225-767-9112, fax 225-767-9108, email mrasouli@dotd.louisiana.gov).

EDITOR'S NOTE: Appreciation is expressed to G. P. Jayaprakash and Amir Hanna, Transportation Research Board, for their efforts in developing this article.

Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-2952, e-mail gjayaprakash@nas.edu).

Pam Ward

Ottumwa Transit Authority

With a population of 25,000, Ottumwa is the largest town within a 75-mile radius in southeast Iowa. Pam Ward went to high school and community college in these rural surroundings before carving out a 30-year career in public transportation, mostly as Transit Administrator for the Ottumwa Transit Authority. Under her supervision, the transit authority operates daily fixed-route bus service and complementary paratransit service in 10 rural counties.

Coordination efforts have been a major part of Ward's career. "In a rural area, it's all about forming partnerships to identify the customers' needs that must be met," she notes. "The value of rural public transportation cannot be underestimated."

The Ottumwa Transit Authority offers a vital service to the frail elderly, for whom a trip to the doctor's office may be anywhere from

20 to 200 miles, depending on medical needs. The transit authority also recently extended its hours of service to start at 4 a.m. and run until midnight Monday through Friday to accommodate residents with nontraditional work hours, such as migrant workers.

Ward's influence, however, extends beyond the plains of Iowa. Her expertise in rural transit has informed the work of Transportation Research Board standing committees and Transit Cooperative Research Program panels. As a member and past chair of the Rural Public and Intercity Bus Committee, Ward has helped plan and conduct several national conferences that examined the demand for, and supply of, passenger transportation in rural areas and intercity bus service.

In many rural states, transit managers do not have a ready outlet to discuss issues and resolve problems. From the early days of her career, Ward found that a wealth of information was available through affiliation with TRB. Under her guidance, Ottumwa Transit Authority has applied research published by TRB to improve practices, from cleaning programs to maintenance work.

"Research helps us identify the challenges our bus operators face, including the safety of passengers, driver fatigue, and dealing with difficult situations," Ward observes. "Besides being able to access the written research and learn about best practices, coming trends, and challenges on the horizon, I discovered, through TRB, a forum for meeting researchers and learning first-hand about their work."

Ward graduated from Indian Hills Community College in 1971, completing course work in data processing and in business and administrative secretarial skills. In 1975 she became the transportation coordinator for the community college, which provided transit primarily to elderly residents.

A year later, the Southern Iowa Economic Development Association in Ottumwa hired Ward as its transportation coordinator, putting her in charge of the daily operations of a 40-vehicle fleet and a staff of 50. She projected capital needs and operating funds and prepared grant applications to state and federal funding sources. Ward also negotiated contracts for services with various agencies, dispatched demand-response services in a 10-county area, and participated in long-range transit planning.

In 1980, Ward joined the staff of the Ottumwa Transit Authority, where she has remained as Transit Administrator for 24 years. For much of that time, she has supervised the fixed-route bus service for Ottumwa. More recently she planned and implemented a complementary paratransit service in accordance with the Americans with Disabilities Act.

She also has assumed responsibilities for a rural bus system under contract to the 10-county Board of Supervisors. To meet these requirements, Ward tripled her staff of bus drivers to 45. She is responsible for capital acquisition, marketing, planning, budget development and monitoring, and statistical reporting to local, state, and federal funding sources.

"The Board of Transit Trustees challenges the staff to reach beyond our current service levels to meet the customers' needs, all the while keeping a focus on efficiency and on our limited financial resources," she reports. "As a staff, we continue to try to find better ways of meeting those needs using technologies, additional partners, and resources not previously tapped."



"Research helps us identify the challenges our bus operators face, including the safety of passengers, driver fatigue, and dealing with difficult situations."

The Ottumwa Transit Authority received the Federal Transit Administration (FTA) Public Service Award in 2002 and the FTA Region 7 Special Achievement Award in 2004. In addition, under Ward's guidance, the transit authority has been recognized three times by the Iowa Department of Transportation (DOT) as Transit System of the Year for service improvements.

Ward has been a member of the Iowa Public Transit Association since 1975 and has served as association president and as vice president of both the rural and the urban divisions. She was appointed a charter member of the national review board for the Rural Technical Assistance Program (RTAP), a national organization that identifies and disseminates information and training to rural transit operators and provides technical assistance services and materials to state programs. She chaired the board for four years before leaving to serve on an advisory group to Iowa DOT as the Iowa RTAP program was being implemented.

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Andrzej S. Nowak

University of Michigan

Transportation engineers regularly encounter bridges that are structurally inadequate for carrying traffic but require considerable funds to fix. Controlling costs when repairing, rehabilitating, or replacing bridges demand the optimal use of materials, energy, and labor. The consumption of those resources can be minimized through rational design criteria, efficient evaluation of structures, and effective repair and rehabilitation procedures.

These are the problems and solutions that have been at the heart of Andrzej S. Nowak's research career over the last three decades. In 25 years as a professor of civil engineering at the University of Michigan, Ann Arbor, Nowak has worked to develop design codes that improve structural reliability of bridges cost-effectively. The field testing procedures have provided an efficient way to verify the analytical models.



“With the new generation of design codes, bridges can be designed to perform with predefined reliability, consistent for different structural types and materials.”

Nowak is developing a calibration procedure for the new generation of load and resistance factor design (LRFD) codes. His procedure has been applied in the American Association of State Highway and Transportation Officials' (AASHTO) LRFD Code for Highway Bridges, the American Concrete Institute's Code for Concrete Buildings (ACI-318), the Ontario Highway Bridge Design Code, and the Canadian Highway Bridge Design Code.

An important focus of Nowak's activities is the evaluation of structures. He has performed diagnostic and field-testing procedures on bridges, including the measurement of truck loads, dynamic loads, girder distribution factors, and proof load tests with military tanks. He has carried out reliability-based procedures for the evaluation of bridges, has developed damage accumulation models for steel and prestressed concrete girder bridges, and has conducted evaluations of potential seismic risk for buildings.

Nowak also is developing probabilistic models for bridge analysis, load models for highway bridges, whole-life reliability profiles for steel girder bridges, and models for human errors in design and construction.

“The new generation of design codes offers a major improvement over the traditional approach,” Nowak notes. “Bridges can be designed to perform with predefined reliability, consistent for

different structural types and materials.”

A native of Poland, Nowak attended the Warsaw University of Technology, receiving a master's degree in structural engineering in 1970 and a doctorate in technical sciences in 1975. He worked as a teaching assistant while pursuing his doctoral studies; afterwards he spent two years as a research associate in the department of civil engineering at the University of Waterloo in Ontario, Canada.

Nowak moved to the United States in 1978 to join the civil engineering faculty at the State University of New York at Buffalo as an assistant professor. The following year, he accepted an appointment at the University of Michigan, where he has ascended the ranks within the department of civil and environmental engineering, to become a full professor in 1990. Nowak has completed partial-year appointments as a visiting professor at universities in Switzerland, Germany, the Netherlands, and Japan.

Nowak teaches courses on the modern approach to bridge analysis, design, and evaluation and on reliability-based methods of structural analysis. His graduate and undergraduate students are often involved in research projects, which Nowak considers a vital complement to their formal education.

“Research projects provide an excellent opportunity for students not only to develop new theoretical approaches and models, but also to apply the knowledge in the field and verify if the theory works in practice,” he observes.

Since 2001, Nowak has served as director of the Center of Excellence in Bridges and Structures at the University of Michigan. The center conducts research projects on the development of bridge load and resistance models and on the evaluation of structures by analysis and field testing. The projects are sponsored by the National Science Foundation, the National Cooperative Highway Research Program, Michigan Department of Transportation (DOT), and other state DOTs.

The author and coauthor of more than 300 publications, Nowak received the American Society of Civil Engineers' Moiseiff Award for his paper on the calibration of LRFD bridge code. He is an active member of several professional organizations in the field of structural engineering, and for the Transportation Research Board he has served as chair of the Structures Section and of the Dynamics and Field Testing of Bridges Committee. Nowak is also a member of the General Structures Committee and of the Committee for the Sixth International Bridge Engineering Conference.

“TRB engages not only academics but also consultants and representatives of the government,” Nowak comments. “TRB provides a diversified forum for the presentation of research results, discussion, and critical comments by peers and others. This ensures a more objective evaluation and verification of new ideas.”

Mileage Counter Could Replace Oregon Gas Tax

Researchers at Oregon State University have successfully tested a system that charges drivers a fee based on the number of miles they travel within the state. The system could one day replace Oregon's gasoline tax, which has yielded less revenue for the highway trust fund since more fuel-efficient cars and trucks have hit the road.

In 2001, Oregon lawmakers requested the state department of transportation (DOT) to develop alternative funding sources for taxing highway use. Oregon DOT awarded a grant to Oregon State University Engineering Professors David Kim and David Porter, to develop two vehicle-miles traveled (VMT) systems.

The VMT systems employ wireless technology to calculate how many miles a vehicle travels between refueling; the systems automatically read the data, compute a total fee, and add the fee to the cost of fuel while the vehicle is at the fuel pump. After a real-time demonstration in May, the researchers declared the system a viable option to the gas tax.

Oregon DOT has instructed the researchers to ensure that the proposed VMT fee would be fair, affordable to implement, and not infringe on personal privacy.

"According to the research Oregon State University has performed, it appears that a VMT fee is a very workable solution," said James Whitty, Manager of the Oregon DOT Office of Innovative Partnerships and Alternative Funding. "Oregon would be the national leader if the Oregon Legislature makes the decision to implement the fee system."

During the May test, researchers drove five vehicles through several zones set up within the city of Corvallis to demonstrate how miles are counted electronically using a Global Positioning System (GPS) or an odometer system and how the user fee is then incorporated into fuel purchases at the gas station pumps.

In response to privacy concerns, Kim stressed that the systems do not allow storage or retrieval of vehicle location, personal information, or the time and date that mileage was logged. "The only information captured is the total number of miles driven since the last refueling," he said.

Kim noted that VMT systems with GPS as part of the on-vehicle device, however, could allow congestion pricing, so that different per-mile rates could apply to different geographic locations or times of day.

For more information on the projects of the Oregon DOT Road User Fee Task Force, go to www.odot.state.or.us/ruff/f/.

Alameda Corridor Fast-Tracks Repayment

In May the Alameda Corridor Transportation Authority (ACTA) paid off the balance of a loan that the U.S. Department of Transportation (DOT) had provided to build the multimodal facility in southern California. ACTA repaid nearly \$573 million to retire the \$400-million loan plus accrued interest—28 years ahead of the scheduled maturity in 2032.

Approved by Congress as part of the 1997 appropriations for U.S. DOT, the loan was instrumental to the construction of the \$2.4-billion Alameda Corridor. A grant from the FHWA federal-aid program contributed another \$347 million to the project.

Opened on time and within budget in April 2002, the corridor has improved freight traffic access to the Ports of Los Angeles and Long Beach, California. The largest component of the corridor is a 20-mile grade-separated rail expressway that connects on-dock terminals to key transcontinental rail yards near downtown Los Angeles. By combining 90 miles of

branch railroads into one high-speed rail line, the Alameda Corridor has eliminated



Secretary of Transportation Norman Y. Mineta visits the Henry Ford Bridge on the Alameda Corridor in April to mark the repayment of a \$573-million U.S. DOT loan for the construction of the \$2.4 billion corridor.

more than 200 railroad crossings where cars and trucks previously had to wait for long freight trains.

ACTA repaid the federal loan with proceeds from the sale of \$1.16 billion of subordinate lien taxable and tax-exempt revenue bonds, allowing it to reduce the 6.79-percent interest rate of the federal loan. ACTA could sell the bonds for two primary reasons: (a) two years of operational performance had confirmed traffic and revenue forecasts, and (b) a recent Internal Revenue Service ruling confirmed the tax-exempt eligibility of a portion of the project bonds. ACTA collects fees on each shipping container that moves between the ports and the rail yards, and has pledged this revenue as the principal source of repayment for the project bonds and the federal loan.

Summarized from the Spring 2004 issue of *Innovative Finance Quarterly*, published by the Federal Highway Administration. For further information on the Alameda Corridor, go to www.acta.org.



The GSI profiler uses sonic technology to measure pavement.

Pavement Profilers Tested at Spring Roundup

The largest road profiler comparison and verification study to date was held in April at Virginia DOT's Smart Road Facility in Blacksburg and at Pennsylvania DOT's road profiler testing facility in Newville. The data collected at the roundup will be used to test the American Association of State Highway and Transportation Officials' provisional standards, adopted in 2002 and published the following year.

The roundup study evaluated 68 road profilers—including high-speed, lightweight, low-speed, walking-speed, and reference devices—that use lasers and other technology to measure pavement smoothness. The measurements taken by the various profilers will be compared with reference profiles of the test roads, to check profiler accuracy, and with the results obtained by the other devices. Additional goals of the study include establishing criteria for selecting profiler verification sites; studying the interaction of profiler types with pavement surface texture; and setting performance requirements for reference profilers.

About 48 states use profilers to evaluate the pavement quality of their road networks; approximately 10 states use profiles for construction quality control on individual projects. Profilers provide a clearer picture of the shape of roads than older devices, such as the California profilograph.

The Maryland State Highway Administration (MSHA) tested its two high-speed profilers, used for

quality assurance on new projects and for some networkwide assessments. Maryland combines the International Roughness Index data collected from networkwide assessments with rutting and cracking data to create a Pavement Condition Index. The index helps the state decide which road projects to work on.

On new projects, Maryland's contractors are required to report on the road's pavement smoothness. MSHA performs sample quality assurance testing to check the accuracy of the contractor's data. Contract incentives are awarded for meeting smoothness targets.

One of the slow-speed devices tested during the roundup was a profiler that uses sonic technology to provide real-time measurements. The device can straddle a pavement slab to profile either wet or cured concrete and asphalt slabs. Any irregularities in the slab are identified, and their locations are recorded through the use of a distance tracking encoder. Contractors can then repair the concrete surface while it is still in a plastic state.

Sponsored by FHWA, the profiler study was performed by the University of Michigan Transportation Research Institute. An overall report on the study results will be issued later this year.

Summarized from the June 2004 issue of Focus, published by the FHWA Office of Infrastructure. To read the entire article on the pavement profiler roundup study, go to www.tfhrc.gov/focus/june04/02.htm.

Barge travels at 3.5 knots as it nears impact with a pier of a recently demolished bridge.



Vessel–Bridge Collision Yields Bargeload of Data

In spring 2004, researchers in Florida crashed a 150-foot barge into channel piers from a demolished bridge, taking advantage of a rare opportunity to test the actual impact of vessel–bridge collisions. Florida DOT sponsored the \$1-million study to obtain reliable and accurate barge impact-load data that could help reduce the cost of bridge construction and improve bridge safety. Conclusions of the month-long test will be available by fall 2004.

Researchers in the Department of Civil and Coastal Engineering at the University of Florida and members from the TRB Structures and Geotechnical Groups conducted about 14 test collisions from late March to late April 2004. The SR 300–Saint George Island Causeway Bridge near Tallahassee, Florida,

was recently demolished, enabling the research team to use two of its channel piers for the study.

The team measured the impact as a 275-ton barge slammed into one of the piers. For a portion of the collisions, a 325-ton payload was added to the barge, which was rented from Boh Brothers Construction Company, LLC.

“This test will help determine the necessary strength standards for piers supporting future bridges,” said University of Florida Assistant Professor Gary Consolazio, who headed the research effort.

The barge crash study, “Prediction of Pier Response to Barge Impacts with Design-Oriented Dynamic Finite Element Analysis,” by Gary R. Consolazio, Jessica L. Hendrix, Michael C. McVay, Mark E. Williams, and Henry T. Bollman, will appear in *Transportation Research Record*, No. 1868, pp. 177-189.

INTERNATIONAL NEWS

Border Delays Costly to Canada, U.S. Economies

Traffic delays at Ontario’s borders with the United States cost the Canadian province \$5.25 billion annually in lost revenue—or more than half a million dollars for every hour that trucks and cars sit idly at border crossings, according to a study released by the Ontario Chamber of Commerce (OCC) in June. Faced with predictions that commercial truck traffic is expected to increase exponentially and that security measures will continue to tighten, the OCC is urging the U.S. and Canadian governments to work together to ensure that the border remains uncongested, or both countries’ economies could suffer.

More than 13 million trucks and 68.3 million personal vehicles crossed the Canadian–U.S. border in 2001. Traffic trying to

enter the United States faced heavier congestion, with wait times ranging from 10 minutes up to 4 hours, according to the study. Due to these delays, both the Canadian and U.S. economies have lost \$13.6 billion annually in productivity and cross-border recreational trips.

The uncertainty of border delays costs logistics and trucking companies more in gasoline and labor, and manufacturers must maintain a higher level of inventory, which the study suggests can affect jobs and consumer prices. The costs are likely to increase over the next 30 years as truck traffic at the border is expected to grow by 118 percent. By then, delays in the Detroit–Windsor corridor alone will cost Canada and the United

States more than \$17.8 billion a year and will result in more than 70,000 jobs lost in Canada, the study notes.

To counteract these trends, the OCC calls on the provincial government, along with the Canadian federal government, to work together with their U.S. counterparts and with the private sector, to create short-, medium-, and long-term plans that include investments in infrastructure, technology, and education of drivers and transportation companies.

For more information, read the entire OCC report, *Cost of Border Delays to Ontario*, at www.occ.on.ca/members/2committees/borders/related_documents/CostofBorderDelays.doc.

Study to Survey Travel Modeling Practice

At the request of the U.S. Department of Transportation (DOT), TRB will undertake a national study later this year to determine the state of the practice in metropolitan area travel forecasting. The study was proposed after TRB's independent review of travel modeling in metropolitan Washington, D.C., which noted the lack of accepted guidelines or standards of practice for travel modeling.

In May 2002, the National Capital Region Transportation Planning Board (TPB), the metropolitan planning organization (MPO) for Washington, D.C., asked TRB to review travel modeling in the D.C. area. MPOs must adopt formal transportation plans and programs to be eligible for federal funding. These often are analyzed using computer models that estimate the current and future impacts of travel and air quality.

Under the auspices of the National Research Council, TRB assembled a committee chaired by David Forkenbrock of the University of Iowa. The committee met several times, heard detailed presentations from TPB staff and stakeholders, and engaged in an intensive review of TPB's models.

The committee issued two letter reports. The first carefully considered the TPB's models for forecasting travel and vehicle emissions and made suggestions for improvements (<http://gulliver.trb.org/publications/reports/mwcosept03.pdf>). The second letter report reviewed the TPB's proposed work program for model improvements (<http://trb.org/publications/reports/mwcoapril04.pdf>).

Although the TPB staff found the review useful and constructive, the TPB staff and the TRB committee pointed out that MPOs do not have a clearinghouse of information to consult about the state of practice or solutions to common problems.

U.S. DOT therefore requested the follow-up study, titled "Determination of the State of the Practice in Metropolitan Area Travel Forecasting." TRB is assembling a committee to select and oversee a contractor to gather and synthesize information on current MPO travel modeling practice. The committee also will make recommendations on the next steps in developing guidance for modeling practice.



TOOL IN DESIGN—(Standing) Wesley Harris, Massachusetts Institute of Technology, is chair of a TRB committee that is evaluating a new Federal Aviation Administration (FAA) tool for assessing the noise, energy, and emissions impacts associated with aviation infrastructure development. The Committee for Developing an Aviation Environmental Design Tool (AEDT) gathered input from the aviation user, operations, manufacturing, and research communities during its first workshop, March 31–April 2 at the National Academies' Keck Center.

In July, the project was expanded to include consideration of analytic tools for an integrated economic assessment of the noise and emissions impacts of aviation operations. Three economists have joined the committee and will participate in the follow-on workshop, August 24–26. (Near right) Tom Connor, FAA, listens to comments during the March workshop.

COOPERATIVE RESEARCH PROGRAMS NEWS

Guidelines for Decked Concrete Girder Bridges

A decked concrete girder is a precast, prestressed concrete I-beam, bulb-tee, or multistemmed girder with an integral deck cast and prestressed with the girder. These girders are manufactured in precast concrete plants under closely controlled and monitored conditions, are transported to the construction site, and are erected so that the flanges of adjacent units abut. Load transfer between adjacent units is provided through specially designed connections.

Sections that are not too long or too heavy for transportation by truck can be used to construct long-span girder bridges. This type of bridge construction provides the benefits of rapid construction, improved safety for construction personnel and the public, and improved structural performance and durability.

Despite these benefits, decked precast, prestressed concrete girders have found only limited use because of design and construction issues that may involve the structural integrity of the bridge system.

Research is needed to address these issues and to develop guidelines for the design and construction of decked concrete girder bridges.

Construction Technology Laboratories, Inc. of Skokie, Illinois, has been awarded a \$500,000, 36-month contract (National Cooperative Highway Research Program Project 12-69, FY 2004) to develop design and construction guidelines for long-span decked precast, prestressed concrete girder bridges. The guidelines will be prepared in a format suitable for consideration and adoption by the American Association of State Highway and Transportation Officials (AASHTO) as part of the *AASHTO LRF Bridge Design Specifications*. These guidelines will provide highway agencies with the information necessary for considering a bridge construction method that is expected to reduce the total construction time, improve public acceptance, reduce accident risk, and yield economic and environmental benefits.

For further information contact Amir N. Hanna, TRB (telephone 202-334-1892, e-mail ahanna@nas.edu).

SHIPPING NEWS—The TRB Committee on the St. Lawrence Seaway held its first meeting June 22–23 in Washington, D.C. The two-phase, 27-month study will identify and explore options to eliminate the introduction of additional nonindigenous species and pathogens into the Great Lakes by oceangoing vessels transiting the St. Lawrence Seaway. The committee will develop a detailed plan for eliciting a range of options that also would promote global commerce.

The centerpiece of the project is a design competition that will identify promising options that warrant further study. The committee will assemble statistics on the economy, trade, transportation, and environment of the Great Lakes region to develop baseline assumptions and criteria for the competition, which will be held at a future event.

(Photo, right) Kathy Metcalf, Director of Maritime Affairs at the Chamber of Shipping of America, responds to a question about the current status of ballast water treatment.



Technical Activities Updates: Legal Resources, System Users

In January 2004, TRB's Technical Activities Division reorganized its approximately 200 standing committees into 11 Groups. Six of the Groups consisting of some 150 committees address various functional components of transportation, with a major focus on highways. Each of the remaining 5 Groups concentrates on a specific mode—public transportation, rail, marine, aviation, and freight systems.

The combined functional and modal structure creates a synergy among the Groups, allowing TRB standing committees to address a variety of specific and cross-cutting transportation research issues, notes Technical Activities Director Mark Norman. Following are highlights of the activities of two Groups.

Legal Resources: Programs and Projects

Breland Gowan, California Department of Transportation, Chair

The 43rd Annual Workshop on Transportation Law, July 18–21 in Savannah, Georgia, included sessions on Transactional Ethics for Lawyers and Engineers; Streamlining Environmental Legislation and Initiatives; How to Avoid Being Roadkill on the Information Superhighway; Homeland Security Issues; and Preparing Today's Construction Transportation Agency for the 22nd Century.

For 43 years, the workshop has provided an opportunity for transportation lawyers across the country to share information with colleagues from other states, the Federal Highway Administration (FHWA), and the Federal Transit Administration, and to discuss approaches to common legal problems. Each year, approximately 150 to 200 people attend the acclaimed summer workshop, which is approved for continuing legal education credits.

The Legal Resources Group sponsored 11 sessions at the 2004 TRB Annual Meeting, including topics on transportation security, the impacts of megaprojects, budget cuts, and false claims on transportation infrastructure. The Group also selected retired FHWA Regional Counsel Richard Jones to deliver the Thomas B. Deen Distinguished Lecture at the Annual Meeting. With guidance from the Group Executive Board, Jones chose a topic integrating law, engineering, and planning—"Context-Sensitive Design: Will the Vision Overcome Liability Concerns?" The lecture will appear in the 2004 series of the *Transportation Research Record: Journal of the Transportation Research Board*.

The Legal Resources Group Executive Board members are working closely with the legal cooperative research projects: National Cooperative Highway Research Program Project 20-6, Legal Problems Arising out of Highway Projects; and Transit Coop-



FIRST MEETINGS—The TRB Committee for a Study of the Feasibility of a Hazardous Materials Transportation Cooperative Research Program is reviewing the current funding of hazardous materials transportation research in programs of U.S. DOT, other government agencies, and industry, to determine whether a cooperative research program



is needed. (Photo, left) Committee members listen to a presentation during the first meeting in late April at the Keck Center. (Photo, right) Committee member Ron Brinson (center) discusses candidate problems for cooperative research during a July 1 workshop, at which stakeholders provided input for the prospective program.

erative Research Program Project J-5, Legal Aspects of Transit and Intermodal Transportation Law. These projects are jointly publishing an eight-volume revised edition of *Selected Studies in Transportation Law*, scheduled for completion by the end of 2005.

Volumes on environmental law, highway torts, and transit labor decisions already have been published. The volumes on contracts and transit law have entered the publication process, and the volumes on eminent domain, transit charter bus service decisions, and transportation law-related topics have yet to be completed and reviewed. *Selected Studies in Transportation Law* is published in hard copy and CD-ROM.

System Users: Starting Up

Barry Sweedler, Safety and Policy Analysis International, Chair

The System Users Group, established in January 2004, consists of the Sections and Committees listed in the accompanying box.

In June 2004, the System Users Groups established the Occupant Protection Committee under the Safety Section. Chaired by Elaine Weinstein of the National Transportation Safety Board, the committee will develop a research agenda that addresses priorities for occupant protection, including restraint system performance, efficiency, and biomechanical issues; the economic impact to society; and behav-

Safety Section

- Transportation Safety Management
- Safety Data, Analysis, and Evaluation
- Operator Education and Regulation
- Traffic Law Enforcement
- Occupant Protection
- Alcohol, Other Drugs, and Transportation
- Safe Mobility of Older Persons
- Truck and Bus Safety

Users Performance Section

- Vehicle User Characteristics
- User Information Systems
- Simulation and Measurement of Vehicle and Operator Performance
- Visibility

Pedestrians and Cycles Section

- Pedestrians
- Bicycle Transportation
- Motorcycles and Mopeds

ioral measures to increase restraint use, such as enforcement and education. The committee will convene an organizing meeting during the January 2005 TRB Annual Meeting.

The System Users Group also established a new TRB paper award in memory of Patricia Waller, the distinguished research scientist and administrator.

DHS-TSA panelists give an overview of research initiatives during the workshop.



Improving Cooperation in Security Research

Five key initiatives for increasing the coordination and collaboration among transportation security research projects were identified during a two-day workshop conducted by TRB in June.

Representatives from 25 TRB standing committees, the U.S. Department of Transportation (U.S. DOT), the U.S. Department of Homeland Security–Transportation Security Administration (DHS–TSA), and other interested partners participated in the Transportation Security Research Workshop: Expanding Opportunities for Collaboration and Coordination, June 14–15 in the National Academies’ Keck Center in Washington, D.C.

The following approaches were advanced to improve cooperation in security research:

- ◆ Taking a systems approach to developing and carrying out a transportation security research agenda,
- ◆ Developing and maintaining a communications

portfolio on transportation security research,

- ◆ Improving understanding among those who are the developers of solutions and the users of those solutions,
- ◆ Facilitating coordination and collaboration among U.S. DOT, DHS–TSA, TRB, and other partners in transportation security research, and
- ◆ Strengthening international links in transportation security research.

The workshop included plenary sessions, with breakout discussion groups on training, education, and technology transfer; vulnerability assessment and risk mitigation; and communications and funding. Serving as moderator for the program was Lillian Borrone, Chair of the Eno Transportation Foundation, former Assistant Executive Director for Port Development at the Port Authority of New York and New Jersey, and past Chair of the TRB Executive Committee. A more complete summary of the workshop discussions will be posted on the TRB website.

TRB E-Newsletter Passes Milestone 100

The 100th issue of TRB’s weekly e-newsletter was e-mailed in mid-July to its 14,000 subscribers in more than 78 countries, marking a milestone for the free research news publication that has generated interest and readership since its launch in June 2002. The e-newsletter assembles summaries with hyperlinks to transportation research studies produced by TRB; federal, state, and international transportation agencies; and universities.

Since its inception, the e-newsletter has attracted 10,000

new subscribers—including more than 2,000 in 2004. Currently, 35 percent of readers are from the private sector, 25 percent from federal and state agencies, 15 percent from academia, and 8 percent from the nonprofit sector. The remainder are predominantly from outside the United States.

To subscribe to the e-newsletter, send an e-mail to rhouston@nas.edu with “TRB E-Newsletter” in the subject field. Confirmation of subscription to the “transresearchnews” list-serv will be sent within 5 business days.

Security in Ports: An ILO Code of Practice

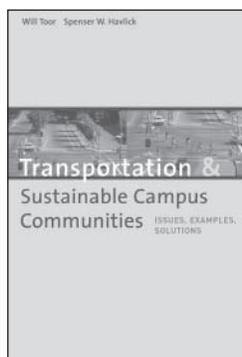
International Labor Organization. 2004; 50 pp.; \$14.95 paperback; 92-211-5286-3.

Security in Ports presents guidelines to help ports reduce the risk of security threats. The code of practice offers a framework for developing and implementing security strategies and for identifying risks. The publication outlines security roles, tasks, and measures to deter, detect, and respond to unlawful acts at ports that serve international traffic and maritime operations.

Transportation and Sustainable Campus Communities: Issues, Examples, Solutions

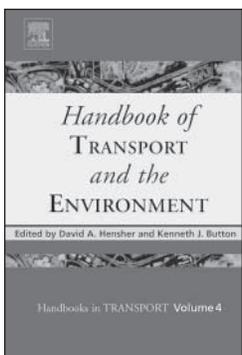
Will Toor and Spenser W. Havlick. *Island Press*. Washington, D.C.: 2004; 293 pp.; \$60 hardback, 1-55963-922-9; \$30 paperback, 1-55963-656-4.

The authors examine techniques for managing transportation in college campus communities, including alternatives to single-occupancy vehicles. The book presents case studies from seven universities in the United States and one in Canada to illustrate the success of transportation demand management programs in a variety of campus communities, from small towns to large cities. Viable options are offered for reducing parking, pollution, land use, and traffic problems.

**Handbook of Transport and the Environment**

Edited by David Hensher and Kenneth Button. *Elsevier Science Ltd*. Amsterdam, Netherlands: 2003; 650 pp.; \$160 hardcover; 00-804-4103-3.

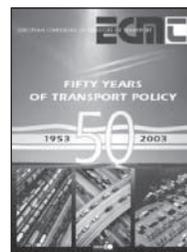
This handbook assesses the environmental impacts of transportation, covering all aspects of the subject, including physical and economic environmental concepts; global warming, air quality, noise, and safety; the role of fuel sources and new technology; the contributions of each transportation sector to energy consumption and emissions; institutional and political settings and policies; the role of legislation; and special topics, such as tourism, public attitudes, and gender. This volume was coedited by David Hensher, member of TRB's Passenger Travel Demand Forecasting Committee, and Kenneth Button, member



of the TRB Committee for the International Symposium on Road Pricing.

Fifty Years of Transport Policy: Success, Failures and New Challenges

Organisation for Economic Co-operation and Development. Bedfordshire, United Kingdom: 2003; 116 pp.; \$29; 92-821-0313-7.



Projected traffic growth no longer can be managed with traditional methods that concentrate on increasing infrastructure capacity. New incentives, new pricing, and new instruments to manage investment and demand are required. This publication outlines strategic directions for transportation policy and includes a summary paper presented at the 87th European Conference of Ministers of Transport.

Completing the "Big Dig": Managing the Final Stages of Boston's Central Artery/Tunnel Project

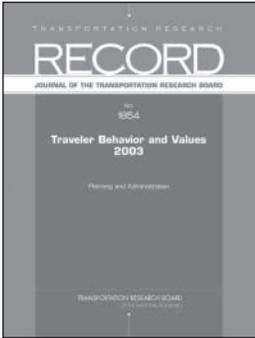
National Research Council. 2003; 60 pp.; \$23 paperback; 0-309-08887-9.

The Massachusetts Turnpike Authority (MTA), the public steward of Boston's Central Artery-Tunnel Project, requested that the National Research Council carry out an independent assessment of the project's management and contract administration practices, with a particular focus on measures that should be taken to bring the project to a successful conclusion. The "Big Dig," a 7.8-mile system of bridges and underground highways and ramps, is the most expensive public works projects ever undertaken in the United States. The original cost estimate of \$2.6 billion already has been exceeded by \$12 billion, and the project will not be completed until 2005, 7 years late.

The report presents the committee's findings and recommendations pertaining to cost and scheduling and examines how to transition the current operations organization, which is dominated by consultants, into one composed largely of full-time MTA staff. The report recommends that MTA establish an external, independent, peer-review program to address technical and management issues until the transition to operations and maintenance is complete; begin a media campaign to teach drivers how to use the new system safely; and develop, immediately implement, and maintain a comprehensive security program.

The books described above are not TRB publications. To order, contact the publisher listed.

TRB PUBLICATIONS

**Traveler Behavior and Values 2003**

Transportation Research Record 1854

Research analyzes trip and stop duration for shopping activities, independent mobility among teenagers traveling to after-school activities, elderly mobility, and household vehicle type decisions. In addition, the impact of underreporting mileage and travel time estimates is discussed in a Global Positioning System-enhanced household travel survey.

2003; 198 pp.; TRB affiliates, \$39; nonaffiliates, \$52. Subscriber category: *planning and administration (IA)*.

**Transportation Data Research**

Transportation Research Record 1855

This volume highlights the development of a commodity flow database from Transearch data, a hybrid model for dynamic travel-time prediction, and a system for collecting loop-detector event data for individual vehicles. An assessment of data-collection techniques for highway agencies and an evaluation of an artificial neural network technique applied to multiple-sensor, weigh-in-motion systems also are included.

2003; 199 pp.; TRB affiliates, \$39; nonaffiliates, \$52. Subscriber category: *planning and administration (IA)*.

Freeways, High-Occupancy Vehicle Systems, and Traffic Signal Systems 2003

Transportation Research Record 1856

Presented are a series of new local ramp metering strategies, effects of changing occupancy requirements for a high-occupancy vehicle lane in California, and extensions and new applications of the traffic-responsive urban control strategy for coordinating signal control. Also included are findings on the state of the practice in high-occupancy vehicle system performance monitoring.

2003; 247 pp.; TRB affiliates, \$42; nonaffiliates, \$56. Subscriber category: *highway operations, capacity, and traffic control (IVA)*.

Transportation Network Modeling 2003

Transportation Research Record 1857

Models for integrated lane-changing behavior, for solving the overlapping problem in route choice, and for the build-operate-transfer scheme under demand uncertainty are examined in the volume. Efforts to optimize a discrete-continuous transportation system and a multiple-route feeder bus service are discussed as well.

2003; 127 pp.; TRB affiliates, \$34.50; nonaffiliates, \$46. Subscriber category: *planning and administration (IA)*.

Geometric Design Consistency on High-Speed Rural Two-Lane Roadways

NCHRP Report 502

This report considers geometric design consistency, particularly for rural roads, and examines rules suitable for use in an expert system such as the Interactive Highway Safety Design Model. The rules can be used in evaluating roadway designs or in conducting reviews of roadways to improve design consistency and safety. The report also considers whether these rules could be applied to multilane highways and recommends text on design consistency for the American Association of State Highway and Transportation Officials' (AASHTO) publication, A Policy on Geometric Design of Highways and Streets.

2003; 83 pp.; TRB affiliates, \$15; nonaffiliates, \$20. Subscriber category: *highway and facility design (IIA)*.

Application for Fiber-Reinforced Polymer Composites to the Highway Infrastructure

NCHRP Report 503

Fiber-reinforced polymer (FRP) composite materials show great potential for use in the highway infrastructure. This report documents the research leading to a strategic plan for guiding the application of FRP materials. The strategic plan and white papers, which are included as appendices, provide a road map for the development of FRP specifications for bridges and other highway applications.

2003; 78 pp.; TRB affiliates, \$15; nonaffiliates, \$20. Subscriber category: *bridges, other structures, and hydraulics and hydrology (IIC)*.

Design Speed, Operating Speed, and Posted Speed Practices

NCHRP Report 504

The relationship between design speed and operating speed is examined through a survey of the practice and an analysis of geometric, traffic, and speed conditions. Also presented is the basis for recent changes in speed definitions in AASHTO's Policy on Geometric Design of Highways and Streets and the Manual on Uniform Traffic Control Devices. The data included on CD-ROM are useful in exploring the relationships between roadway factors and operating speed.

2003; 93 pp. plus CD-ROM; TRB affiliates, \$15.75; nonaffiliates, \$21. Subscriber category: *highway and facility design (IIA)*.

Review of Truck Characteristics as Factors in Roadway Design

NCHRP Report 505

Guidance is presented for roadway geometric designers on how best to accommodate large trucks on the U.S. highway system. The report includes recommendations for several changes to the AASHTO Policy on Geometric Design of Highways and Streets.

2003; 183 pp. and diskette; TRB affiliates, \$22.50; nonaffiliates, \$30. Subscriber category: *planning and administration (IA)*; *highway and facility design (IIA)*; *highway operations, capacity, and traffic control (IVA)*.

Emerging New Paradigms: A Guide to Fundamental Change in Local Public Transportation Organizations

TCRP Report 97

This report examines how public transportation organizations have entered an era of fundamental change and how they are responding to new expectations and imperatives that have triggered the emergence of a new paradigm throughout business and industry worldwide. The report focuses on six dimensions of change: mission shift, obsession for the customer, collaboration, integration, information technology, and organizational structure change.

2003; 104 pp.; TRB affiliates, \$16.50; nonaffiliates, \$22. Subscriber categories: *planning and administration (IA)*; *public transit (VIA)*.

Resource Requirements for Demand-Responsive Transportation Services

TCRP Report 98

Documented in this report is a methodology for determining the resources required for demand-responsive transportation at different levels of demand and different levels of service in a given service area. An accompanying software tool and user manual on CD-ROM can assist in developing estimates.

2003; 42 pp. and CD-ROM; TRB affiliates, \$21; nonaffiliates, \$28. Subscriber categories: *public transit (VIA)*.

Embracing Change in a Changing World: Case Studies Applying New Paradigms for Rural and Small Urban Transit Service Delivery

TCRP Report 99

Case studies show how some transportation providers are addressing the opportunities and challenges of a rapidly changing rural environment.

2004; 27 pp.; TRB affiliates, \$12.75; nonaffiliates, \$17. Subscriber categories: *planning and administration (IA)*; *public transit (VIA)*.

Transit Capacity and Quality of Service Manual, 2nd Edition

TCRP Report 100

This comprehensive manual for practitioners assembles a consistent set of techniques for evaluating the quality of service and capacity of transit services, facilities, and systems. The manual is the primary source document incorporating research findings on transit capacity and quality of service.

2003; 572 pp. and CD-ROM; TRB affiliates, \$33.75; nonaffiliates, \$45. Subscriber categories: *planning and administration (IA)*; *public transit (VIA)*; *rail (VII)*; *marine transportation (IX)*.

Integrating Freight Facilities and Operations with Community Goals

NCHRP Synthesis 320

The freight transportation system is the national link to the global economy. At the same time the system plays a vital role in the economic well-being of businesses and residents. The increasing amount of freight traffic, however, has raised several community issues, including concerns about traffic flow and congestion, safety and security, air quality and the environment, noise and vibrations, and land use and value.

Balancing freight transportation and community interests requires cooperative efforts by the private sector, the public sector, and communities. This synthesis identifies successful efforts in the location and operation of freight transportation facilities. It presents information on a range of practices that enable freight facilities and operations to be good neighbors within their communities.

2003; 58 pp.; TRB affiliates, \$11.25; nonaffiliates, \$15. Subscriber category: *freight transportation (VIII)*.

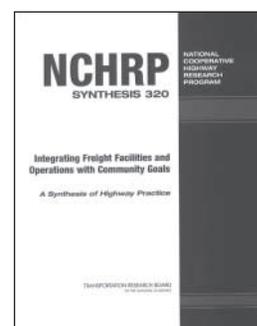
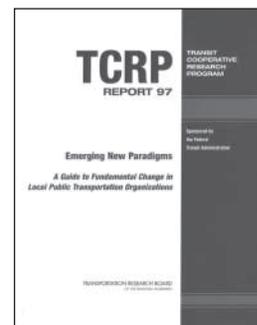
Roadway Safety Tools for Local Agencies

NCHRP Synthesis 321

Local governments implementing road and safety improvements face significant challenges. Local roadway networks can vary from a few city blocks to thousands of miles of paved, dirt, or gravel roads. Agencies responsible for these roadways often have limited resources, staffs, and knowledge of the variety of tools available to improve the safety of their roadway networks.

This synthesis provides a summary of safety tools for local agencies with procedures that are practical and relatively easy to apply. Emphasis is given to developing a local safety and improvement program tailored to fit agency needs and available resources.

2003; 168 pp.; TRB affiliates, \$15; nonaffiliates, \$20. Subscriber categories: *highway operations, capacity, and traffic control (IVA)*; *safety and human performance (IVB)*.



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FEATURES are timely articles of interest to transportation professionals, including administrators, planners, researchers, and practitioners in government, academia, and industry. Articles are encouraged on innovations and state-of-the-art practices pertaining to transportation research and development in all modes (highways and bridges, public transit, aviation, rail, and others, such as pipelines, bicycles, pedestrians, etc.) and in all subject areas (planning and administration, design, materials and construction, facility maintenance, traffic control, safety, geology, law, environmental concerns, energy, etc.). Manuscripts should be no longer than 3,000 to 4,000 words (12 to 16 double-spaced, typewritten pages), summarized briefly but thoroughly by an abstract of approximately 60 words. Authors should also provide appropriate and professionally drawn line drawings, charts, or tables, and glossy, black-and-white, high-quality photographs with corresponding captions. Prospective authors are encouraged to submit a summary or outline of a proposed article for preliminary review.

RESEARCH PAYS OFF highlights research projects, studies, demonstrations, and improved methods or processes that provide innovative, cost-effective solutions to important transportation-related problems in all modes, whether they pertain to improved transport of people and goods or provision of better facilities and equipment that permits such transport. Articles should describe cases in which the application of project findings has resulted in benefits to transportation agencies or to the public, or in which substantial benefits are expected. Articles (approximately 750 to 1,000 words) should delineate the problem, research, and benefits, and be accompanied by one or two illustrations that may help readers better understand the article.

NEWS BRIEFS are short (100- to 750-word) items of interest and usually are not attributed to an author. They may be either text or photographic or a combination of both. Line drawings, charts, or tables may be used where appropriate. Articles may be related to construction, administration, planning, design, operations, maintenance, research, legal matters, or applications of special interest. Articles involving brand names or names of manufacturers may be determined to be inappropriate; however, no endorsement by TRB is implied when such information is used. Foreign news articles should describe projects or methods that have universal instead of local application.

POINT OF VIEW is an occasional series of authored opinions on current transportation issues. Articles (1,000 to 2,000 words) may be submitted with appropriate, high-quality illustrations, and are subject to review and editing. Readers are also invited to submit comments on published points of view.

CALENDAR covers (a) TRB-sponsored conferences, workshops, and symposia, and (b) functions sponsored by other agencies of interest to readers. Because of the lead time required for publication and the 2-month interval between issues, notices of meetings should be submitted at least 4 to 6 months before the event. Due to space limitations, these notices will only appear once.

BOOKSHELF announces publications in the transportation field. Abstracts (100 to 200 words) should include title, author, publisher, address at which publication may be obtained, number of pages, and price. Publishers are invited to submit copies of new publications for announcement, and, on occasion, guest reviews or discussions will be invited.

LETTERS provide readers with the opportunity to comment on the information and views expressed in published articles, TRB activities, or transportation matters in general. All letters must be signed and contain constructive comments. Letters may be edited for style and space considerations.

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