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Cover: Soldier directs loading of CSX railcar at Fort Campbell, Kentucky. (Photo courtesy of U.S. Strategic Deployment and Distribution Command.)

TR NEWS

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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COMING NEXT ISSUE

A longlife asphalt concrete project on the Long Beach Freeway in California exemplifies the "get in, get out, stay out" approach for highway construction.

The May—June 2004 *TR News* features an overview of the milestone *Transit Capacity and Quality of Service Manual*, 2nd Edition, recently released by the Transit Cooperative Research Program; practical insights into the get in, get out, stay out approach to pavement renewal for urban highways; and more.

Remodeling the PANAMA CANAL

Master Plan for Modernization and Global Market Appeal

RICAURTE VASQUEZ

The author is Deputy Administrator, Panama Canal Authority, Balboa, Ancon, Panama.

In the 16th century, the Spanish galleon trade sailed along the Pacific Ocean with goods from Pacific South America to Panama; after transport over the isthmus, the goods were shipped across the Atlantic Ocean to Spain. This route of trade and commerce led to the creation of the Panama Canal.

Historian David McCullough, in his book, *The Path Between the Seas*, noted that the Panama Canal was far more than a vast, unprecedented feat of engineering. The canal affected the lives of tens of thousands of people at every level of society and of virtually every race and nationality. According to McCullough, the waterway enabled the United States to embark on a role of global involvement, opening up the world to the United States and vice versa.

Strategic Location

Because of its strategic location, the Panama Canal has played a vital role in international trade and commerce since 1914. At the heart of the western hemisphere, the canal traverses the shortest distance between the Pacific and the Atlantic oceans. The 51-mile waterway cuts across the Panamanian isthmus, climbs 87 feet above sea level, crosses the continental divide, and returns to sea level, joining the Pacific Ocean and the Caribbean Sea.

The advantageous location makes the Panama Canal a nexus of many major trade routes, strengthening commercial ties among the United States, Asia, Latin America, and Europe. Each year, more than 12,000 vessels sail the canal, carrying a significant portion of the world s goods and commodities, ranging from grain to coal, from crude oil to iron ore, and from fruit to automobiles.

For many years, the canal has played a pivotal role in the U.S. and world economies as an all-water route with dependable, around-the-clock, 365-days-a-year service, shortening the time and travel distance between producers and consumers, suppliers and retailers. The canal lowers transportation and labor costs for shippers, ultimately reducing prices for consumers.

Fourteen percent of all U.S. seaborne trade passes through the canal, and approximately 60 percent of canal traffic originates and ends at U.S. ports. Imported products of high and low commercial value traverse the canal en route to East Coast destinations.

Panamax container vessel exits the Panama Canal's Gatun Locks into the Atlantic Ocean. Lake Gatun is in the background.

The United States is the world s largest exporter of grains and soybeans. These commodities ship through the canal to destinations in Japan, South Korea, and Taiwan in Asia, and in Chile, Peru, and Ecuador in South America. In today s global trade, the canal remains a strategic transportation option for the United States and the world.

Market-Oriented Model

The Panama Canal Authority, an autonomous public entity that operates independently of the government of Panama, manages the canal. The canal s managers are experienced, seasoned leaders from the business, finan-

Container vessel transiting the Panama Canal's Gaillard Cut. The skyline of Panama City is visible in the background.

cial, engineering, transportation, maritime, and environmental sectors. An advisory board of distinguished shipping, business, and maritime leaders from around the world oversees the Authority.

The Authority has a legislative mandate to protect and maintain the canal watershed. As a responsible corporate citizen of Panama, the Authority is reforesting denuded areas and donating land titles to subsistence farmers.

To maintain and extend the canal s key role in commerce and in the development of the world s major economies, the Panama Canal Authority is working on strategic and innovative ways to serve customer needs. After the U.S. transfer of ownership to Panama in 1999, the canal entered a new era in its 90-year history, moving from a profit-neutral operation to a market-oriented model, focusing on customer service and reliability.

An innovative toll structure was established to address the evolving needs of customers. In the first phase, implemented in 2002, tolls increased an average of 8 percent. The second phase went into effect in July 2003, with an average increase of 4.5 percent. The tolls contribute to funding increased customer service and ongoing improvements to the canal.

Despite the toll increases, the Panama Canal remains a bargain for shippers. It is more expensive to unload containers from the Far East at the congested ports of Los Angeles and Long Beach, California, and then move the containers along the Alameda Corridor to the East Coast than it is to land the containers directly at East Coast ports via the Panama Canal. The all-water route may take a few days more, but the cost is competitive compared with the costs of multimodal handling.

Excavation work during canal construction period.

Capital Improvements

Ongoing capital improvements to the canal have focused on two priorities: increasing safety and decreasing the Canal Waters Time (CWT), the time a ship takes to traverse the waterway.

The Authority has established an outstanding safety record. Since the Authority assumed control of the Canal, the number of maritime accidents has decreased steadily. From 2001 to 2002, only 34 maritime accidents occurred in a total of 26,678 transits, a reduction of 40 percent from fiscal years 1999 to 2000.

The reduction in CWT is equally impressive. From 2001 to 2002, the CWT has decreased to 26.2 hours, down from 31.15 hours in 1999 to 2000.

The Authority also has launched a proactive program of modernization, with a series of improvements that will increase canal capacity by 20 percent and that will boost navigational safety and reliability. Four flagship projects underpin these efforts: the widening and deepening of the Gaillard Cut, the purchase of new locomotives, the addition of tugboats, and the enhancement of security measures.

◆ The Gaillard Cut, also known as the Corte de Culebra, is the narrowest part of the canal. The cut recently was widened and deepened in less than 1 y e a r record time for such a project. The improvement allows two-way traffic and has increased canal traffic by 16 percent.

◆ The Authority also has increased the locomotive fleet from 80 to 100 and has ordered another 40 vehicles. The new, more powerful locomotives help position large ships traveling through the locks, including Panamax vessels the largest type of vessel able to pass through the canal and about 37.9 percent of canal traffic. With more and more Panamax ships transiting the canal each year, locomotives are indispensable in ensuring safe passage.

◆ The canal fleet has increased with the acquisition of new tugboats. The tugboats assist vessels efficiently during transits, especially at the entrances and exits to locks, as well as through the Gaillard Cut.

◆ In response to the heightened security demands after September 11, 2001, the Authority has enhanced security operations and strengthened coordination with U.S. and international agencies. State-of-the-art technology ensures safe passage for all ships. A 24-hour security control center employs closed circuit television surveillance and a tracking system with a maritime operations information database. In addition, the

Authority works closely with Panama s police and National Maritime Service, or Coast Guard, to protect the waterway.

Master Plan

These profound changes have brought canal operations up-to-date, but greater challenges remain. A 20-year master plan for modernization is in development, to improve the Panama Canal s long-term viability. Two major research initiatives will lead to significant benefits for canal customers: first, studies to determine the future requirements of the waterway and, second, the development of engineering designs and water recycling options for larger locks.

More than 150 studies are under way to help the Authority respond effectively to changes in the market. Key studies involve analyses of market demand and include assessments of the social and environmental impacts of proposed changes.

Also under study are new concepts in lock design and engineering, through contract by the Authority with the U.S. Army Corps of Engineers and the Belgian-French consortium of Tractebel Development Engineering, Coyne-et-Bellier, Technum N.V., and Compagnie Nationale du Rhone. Results from these studies will enable the Authority to apply new engineering technologies in the construction and operation of locks.

If larger locks become necessary, water recycling methods may reduce the fresh water requirements. Alternative measures, such as building dams to create new lakes, could affect towns and settlements. Environmental issues play a major role in defining future directions and programs. The Authority is committed to the principles and practices of sustainable development, which will be incorporated into the final master plan.

Cornerstone and Model

The transfer of the Panama Canal from U.S. to Panamanian control has provided an excellent opportunity for long-term planning. The Authority is using the opportunity to enhance the role of the Panama Canal and to demonstrate the canal s advantages in the global marketplace.

The Authority is forging ahead with a vision of the Panama Canal as the cornerstone of the global transportation system and as a model of excellence, integrity, and transparency in operations and customer service. The canal benefits not only Panama, but major trading nations, serving the U.S. and the global economies. The Panama Canal is a strategic transportation choice.

Two Panamax vessels pass in Gaillard Cut.

Identifying Ships on the Panama Canal

MARTHA R. GRABOWSKI, STEVE HUNG, AND ARCELIO HARTLEY

The Panama Canal Authority mandated automatic identification systems (AIS) on board ships in canal waters as of July 1, 2003, three months after the United States instituted the requirements for ships on the Great Lakes and St. Lawrence Seaway. To transit the Panama Canal, vessels of more than 300 gross tons or more than 20 meters long must be equipped with an AIS that meets the standards of the International Maritime Organization (IMO). In combined and multiple units—for example, tug-and-tows—the tugboat must be equipped with AIS.

To assist vessels that arrive without functional AIS, the Panama Canal Authority is offering vessel-tracking, pilot-portable AIS units for rent at U.S. $150 per transit until December 31, 2004. The U.S. Department of Transportation's Volpe Transportation Systems Center developed the units for the canal, and the Authority has adopted the technology to track its own tugboats, launches, and dredges.

The Authority also has interfaced the Volpe technology with the canal's new AIS network and port radar systems. The integrated system allows canal pilots and floating equipment operators to detect vessels and radar signals on both systems. The Authority is developing enhancements that include providing weather information to pilots.

Shipboard AIS transponders for Panama Canal transits must be Class A units—that is, meeting type-approved standards—and must comply with the IMO Guidelines for Installation of Shipborne AIS.[1] The Authority also requires a clearly labeled pilot plug close to conning position No. 1 on the navigation bridge. In addition, a U.S. standard 120-volt, alternating-current, three-prong power receptacle is necessary to run the pilot's laptop computer, with a connection to an emergency power source.

According to advisories from the Panama Canal Authority,[2] some AIS units on ships arriving at the canal are not operating correctly. Many of the most common deficiencies detected early on have been remedied—for example, incorrect data on ship dimensions, gyroscope not connected to the AIS, and inability to recalculate internal Global Positioning System coordinates. Pilot plugs not wired according to IMO guidelines, however, remain a problem. Additional early feedback and results from AIS use on the Panama Canal will be available later this year.

[1] www.imo.org/includes/blastData.asp/doc_id=2741/227.pdf.

[2] www.pancanal.com/eng/maritime/advisories/index.html.

Grabowski, a member of the TRB Marine Board, is Director, Information Systems Program, Le Moyne College, Syracuse, New York, and Research Professor, Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, Troy, New York. She chaired the National Research Council Committee for Evaluating Shipboard Display of Automatic Identification Systems. Hung recently retired as Director of Engineering and Planning, St. Lawrence Seaway Development Corporation, Massena, New York, and lives in Frederick, Maryland. Hartley is Director, Internal Maritime Affairs, Panama Canal Authority, Ancon.

MILITARY DEPLOYMENT and Commercial Transportation Services

Survey of an Evolving Partnership

CARL J. SEIBERLICH

Loading vehicles and equipment onto the U.S. Naval Ship *Pollux*, a large medium-speed roll-on, roll-off vessel, Corpus Christi, Texas, February 2004.

The author is a retired Rear Admiral, U.S. Navy, and Intermodal Consultant, TranSystems Corporation, Reston, Virginia.

At the Summer Ports and Waterways Conference in Portland, Oregon, July 2003, the Transportation Research Board s Military Transportation Committee convened a group of military and commercial freight transportation experts to review the effects of deployment on U.S. transportation providers and their customers. Under the guidance of Committee Chair Arlene L. Dietz, Director of the Navigation Data Center, U.S. Army Corps of Engineers, program participants reviewed lessons learned in the Desert Shield—Desert Storm operations, as well as actions and programs to improve the military—commercial partnerships and transportation efficiency in peacetime and in national emergency. Panelists evaluated transportation performance in Operation Enduring Freedom and Operation Iraqi Freedom.

Supporting the Warfighter

Frank Galluzzo, Director of the Distribution Analysis Center of the Surface Deployment and Distribution Command (SDDC) formerly known as the Military Traffic Management Command reviewed the mission of managing distribution and services globally to meet national security objectives in peace and war. One of three component commands of the U.S. Transportation Command (USTRANSCOM), SDDC coordinates shipments to deploy and sustain warfighting units.

On one of the busiest days in the global war on terrorism, SDDC managed more than 515 air missions, more than 157 ships on ocean missions, and more than 10,000 ground shipments, Galluzzo reported. From April to July 2003, SDDC shipped more than 59 million MREs or Meals Ready to Eat.

In shipping equipment, one goal is to reduce the

need for assembly in the theater of operations, delivering combat capability to the battlefield. Among the new business processes instituted for both deployment and sustainment was total asset visibility the electronic identification and tracking of surface movements. One main benefit was avoiding stacks of containers like those that had mounted in the theater of operations during Desert Shield—Desert Storm.

SDDC and USTRANSCOM are integrating supply and transportation to support the warfighter. External and internal initiatives are under way to address the transformation of SDDC to support U.S. forces.

Trucking: Achieving Balance

Daryl Deel, Chief Executive Officer of R&R Trucking Company, examined the experience of the trucking industry in support of military transportation. Deel also chairs the Surface Committee of the National Defense Transportation Association (NDTA) and the Government Traffic Committee of the American Trucking Associations.

The 29 percent increase in shipment volume for 2002 exceeded the 15 percent increase in truck capacity, presenting problems in meeting commercial customer needs while supporting military requirements. Planning, prioritization, and coordination for military shipments add to the industry s problems. Shipping delays at one military installation can cause a domino effect on a carrier s ability to meet other military shipment requirements.

Motor carriers must achieve a balance between meeting the Department of Defense s (DoD) shipping demands for deployment and maintaining financial viability. Enhanced security increased transit time and has raised problems in gaining driver clearances, entering military installations, and responding to requirements for security in transit.

Commercial truck drivers consult on delivery of military vehicles to port.

Bridging equipment arrives by rail in Charleston, South Carolina, for transport to Iraq on U.S. Naval Ship *Bob Hope*, October 2003.

After deployment, motor carriers and DoD may benefit from a review, to identify lessons learned and corrective actions to be taken, Deel advised. For example, funds should be appropriated to reimburse motor carriers for DoD-mandated security technology. A new program should review and identify driver safety issues.

Rail: Building Discipline

Five major rail carriers Burlington Northern Santa Fe Railway, CSX Transportation (CSXT), Union Pacific, Kansas City Southern Railway, and Norfolk Southern account for the majority of U.S. rail revenue, and all provide support for the military. The challenges for rail carriers in meeting military transportation demands are resource planning, peacetime traffic opportunities, and equipment utilization with declining rail fleets.

Jon S. Meyer, Senior Account Manager for CSXT, presented the rail experience in supporting military transportation. CSXT operates 23,000 track-miles serving 70 ocean, lake, and river ports with an average of 1,600 trains daily.

During Operation Iraqi Freedom, rail deployment went well, except for early problems with port congestion at Corpus Christi, Texas, and Blount Island, Florida, Meyer reported. The rail car ordering process needs a more disciplined appro a c h despite generally good availability, spot shortages of rail cars arose, along with instances of poor utilization of equipment. Motor carriers often had to support and supplement the rail operations.

Daily conference calls, improved information flow, daily rail status reports, and improved in-transit visibility effected an evolution in SDDC s rail traffic management process and procedures. Problems were encountered with port calls that were

Photographs courtesy of Surface Deployment and Distribution Command.

(*Left*) Closeup of radio frequency identification tag on container carrying Stryker vehicle support equipment and (*right*) worker checking the tag, port of Philadelphia, October 2003.

not in accordance with plans, that lacked priority rankings, and that were issued on short notice.

Some DoD installations do not use rail. Mechanical, ownership, and deployment issues must be addressed, Meyer advised. The majority of rail cars at military installations are empty, causing redeployment problems. USTRANSCOM and SDDC are working with rail carriers to address the problems with port calls, equipment utilization, and marketing.

Sealift: Joint Planning

The warfighter s sealift requirements during Operation Iraqi Freedom were met by U.S.-flag ships and their intermodal systems, and by the U.S. organic fleet, or active-duty force, noted Lou Lambremont, Director of Military Marketing for Maersk, Ltd. The organic fleet included 40 vessels from the Ready Reserve Force (RRF).

All vessels were manned by U.S. labor. Maersk reflagged four of eight vessels in the Suez Express service to the U.S. flag, Lambremont said. Since the completion of the surge phase, the vessels have been supporting sustainment of U.S. forces in the Middle East.

Joint planning was critical to the success of the Operation Iraqi Freedom sealift. The USTRANSCOM Joint Planning Advisory Group planned both the surge and the sustainment phases of the operation. Because the carriers with peacetime contracts provided adequate lift to meet military requirements, the Voluntary Intermodal Sealift Agreement (VISA) was not activated.

In-transit visibility and total asset visibility were successful, Lambremont noted. Operation Iraqi Freedom was the first contingency to use mandatory radio frequency tags to identify and track all containers carrying Class I (subsistence) and Class IV (construction and barrier material) cargo. A documentation rule required carriers to obtain a release from SDDC operations in Ft. Eustis, Virginia, before lifting a container.

The lessons learned from Desert Shield—Desert Storm resulted in significant sealift improvements for Operation Iraqi Freedom. Berthing assignments at in-theater ports, however, remained a problem. Because of draft restrictions, U.S.-flag vessels were limited to 50 to 60 percent of optimal capacity and did not receive priority in berthing assignments. Obtaining chemical, biological, and radioactive protection equipment and inoculations for merchant crews was difficult.

In-theater logistics used trucking assets inefficiently, the speaker said. Port terminals were unprepared for the surge volumes. Although in-transit visibility and total asset visibility were successful, electronic data interchange requires review and updating. The sustainment stage should be reviewed and improved. The Maritime Security Program is a vital element in U.S. strategic sealift and must be reauthorized, Lambremont stated.

Ports: Effective Transitions

In the early 1990s, base closures removed the military ports of Bayonne, New Jersey, and Oakland, California. As a result, according to Fred Stribling, Director of Marketing and Sales, South Carolina State Ports Authority, DoD cargo shifted to commer-

Big Lift

In February 2004, more than 40,000 U.S. troops moved into the Operation Iraqi Freedom theater of operations, and 35,000 departed for home. The rotation was the largest troop movement since World War II, according to Department of Defense officials.

The complex, multimodal transportation effort, directed by the U.S. Transportation Command, was comparable in scope to the World War II invasion of Normandy "in both directions," according to a military logistics officer in Kuwait. The mission required a heightened focus on the synchronized movement of lift assets—that is, available vehicles and modes of transport—into and out of the theater of operations, noted Brigadier General David Rodriguez of the U.S. Army.

For the rotation, more than 50 vessels using 10 seaports carried more than 350,000 short tons of equipment to and from the theater, Rodriguez said. "More than 90 military aircraft and 20 commercial aircraft were involved daily in the transfer of personnel and equipment."

cial port facilities, which had an effect on the commercial shipping business at the ports. Norfolk, Virginia; Charleston, South Carolina; Savannah, Georgia; and Jacksonville, Florida, support Operation Iraqi Freedom operations.

Waterfront property is limited. Marshalling and reprioritizing should not take place in the marine terminal, but nearby, Stribling noted.

Rail load capacity has increased at ports, but reception capacity has not. During periods of increased cargo flow, berthing constraints and the availability of labor with the required expertise become significant problems. Communication is key and must be established in peacetime to ensure that requirements for mobilization deployment are met.

The flow of both cargo and information from port to port must be optimized. On-time arrival is essential for military cargo. Stribling identified the following steps to ensure an effective transition from peacetime to wartime or to national emergency operations:

- Reinforcing the role of the local Port Readiness Committee;
- Investigating the availability of federal funds to enhance port terminal rail capacity;
- Developing secure, near-terminal marshalling areas; and
- Approaching problems with a can-do attitude.

Coordinating Commands

As a retired U.S. Navy Rear Admiral and as an intermodal consultant with TranSystems Corporation, I provided a review of the Desert Shield—Desert Storm operations and the improvements in planning and coordination that DoD commands have implemented with the commercial carriers supporting military transportation.

USTRANSCOM is essential to the success of these operations. Originally the three subordinate commands SDDC, Military Sealift Command (MSC), and the Military Airlift Command came under military command only during war or national emergency. After Desert Shield—Desert Storm, the three commands were placed under USTRANSCOM at all times. This restructuring has improved preplanning, preparation, and coordination of intermodal transportation.

At the outset of Desert Shield—Desert Storm, the need for improvements in contracting and planning procedures and in the use of the intermodal container system became apparent. Actions were taken to strengthen partnerships and to provide capacity for reliable delivery. Problems arose with trucking-in-country, the use of alternative ports, and identifying commodities.

First commercially booked maritime cargo unloading from vessel *Sima Tara* at Iraqi port of Umm Qasr, September 2003. The test validated use of the port to reduce supply lines for U.S. forces and to boost Iraqi economic growth and infrastructure development.

I pointed to the following measures to strengthen the working relationship between the military and the commercial intermodal sector and to improve results in a national emergency:

- Develop a readiness-based procurement system to ensure that the merchant marine and its intermodal system can support military lift requirements immediately. Maintain a mobilization base within the merchant marine and its intermodal network. Develop an off-the-shelf, prenegotiated rate and cargo distribution system, along with other mechanisms to preclude lengthy negotiations and to deploy assets without delays.
- Develop a contingency planning process to anticipate logistics scenarios, including security clearances, so that military and industry can part-

Equipment of 25th Infantry Division ready for loading onto U.S. Naval Ship Pililaau, Pearl Harbor, Hawaii, for deployment to Iraq, December 2003.

Intermodal transportation demonstration, October 2003, at port of Philadelphia, which offers railroad track access (*left*) at riverside, adjacent to Landing Craft Utility Runnymede (*right*).

ner in planning and coordinating transportation.

- The container transportation company APL and other carriers should continue to work with TRANSCOM, SDDC, and MSC to demonstrate the full capability of the industry s integrated transportation and distribution systems. The military should use not only the ships but also the related intermodal and information systems of the U.S.-flag liners, including commodity identification and cargo tracking, as well as logistics expertise. For example, a contract for a percentage of the integrated system could ensure that the system would remain balanced and intact for military and commercial users and increase military efficiency and productivity. This approach is consistent with the strategic thinking that characterizes military planning.
- Plan to maximize use of the liner sector and its infrastructure during the surge phases of national emergencies, as well as during sustainment. Military and industry can work together to improve access to materiel that can be transported in containers.
- Address the regulatory barriers that deny industry the flexibility to redeploy assets quickly in response to military requirements.
- U.S. liner companies and military authorities need to have appropriate plans in place to allow liner companies to provide the benefits of their intermodal systems, even if needs arise in areas that do not have container-handling facilities. USTRANSCOM can take an active role in this process.
- Review RRF contracting procedures, as well as funding for maintenance and repair programs, to enable contractors to meet military activation schedules.

Since completion of Desert Shield—Desert Storm operations, USTRANSCOM has established a partnership with commercial carriers and has worked with the three subordinate commands to strengthen the partnership. All of the problems experienced in Desert Shield—Desert Storm have been addressed. Information systems have undergone a major reorganization. The Joint Planning Advisory Group was established and is functioning effectively. VISA has worked as designed. NDTA has been effective in working with both military and industrial organizations.

Applying the Latest Lessons

The presentations at the meeting identified major problems in managing the intermodal system in time of war or national emergency. Scheduling is necessary to make the most efficient and effective use of transportation assets, such as ship terminals and berths, rail yards, and truck terminals, and to provide realistic transit times. Problems emerged at yards and terminals in the United States and overseas.

Solutions must consider the commercial requirements of transportation carriers and the requirements of the military in peace and war. Planning and coordination are required in peacetime, during the transition to emergency operations, and in wartime.

Operation Enduring Freedom and Operation Iraqi Freedom applied the lessons learned from Desert Shield—Desert Storm operations. Military and commercial transportation organizations must continue to address the newly identified problems and apply the lessons.

Longshoremen move shrink-wrapped OH-58 Kiowa helicopter onto U.S. Naval Ship *Sisler*, Port of Tacoma, Washington, October 2003.

ENLISTING FAST FERRIES for Military Missions

U.S. Armed Forces Try Out New High-Speed Vessels

DAVID S. CHAPMAN

PHOTO: U.S. NAVY

High-speed vessel *Swift* participating in the West African Training Cruise 2004, a regularly scheduled exercise conducted by the United States and several African nations since 1978.

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A transformation is under way in the U.S. Navy. With aging vessels and budget constraints, but an expanding global mission, the Navy is committed to identify and integrate emerging technologies that will keep its fleet on the cutting edge. Innovative thinking is fostering the Navy s transformation, going beyond conventional solutions and ship acquisition practices to find the maximum cost-efficiency.

Commercial fast ferry technology is one of the ship concepts that the Navy is evaluating. Fast ferries have proved their worth in commercial service and have become one of the fastest-growing segments of the international and domestic marine industries.

Speed, shallow draft, and maneuverability allow fast ferries to perform missions that would place larger, multimission ships in vulnerable positions. Relatively low cost and high reliability make fast ferries attractive candidates for augmenting the fleet.

Urban ferry transportation declined after World War II, as bridges and tunnels were constructed. Personal automobiles have been the favored mode of transportation for decades. The increase in commuter traffic, however, has outpaced infrastructure expansion in many cities; fixed crossings have become overcongested, and the addition of fixed crossings is too expensive. This has set the stage for the return of ferries.

Water transit has become more and more popular as an alternative mode, less congested and more attractive than fixed crossings. Commuter ferry services have resurged in New York, Boston, and San Francisco.

Fast Ferry Surge

Fast ferry commercial applications are relatively new to the United States, and even newer to the U.S. military. Nonetheless, the military has adopted several high-tech marine applications that have found only limited commercial use in the United States such as air cushion vehicles (or hovercraft), small waterplane-area twin-hull (or SWATH) vessels, and hydrofoils.

The high-speed catamaran ferry, however, is a high-tech application that has gained rapid adoption in the U.S. commercial market in the last decade. The U.S. fast ferry market has grown at an annual rate of 15 percent in the past 5 years (*1*). Although Australian designs have dominated the market, European designs play a significant role, and U.S. builders of fast ferries have been adept at imitating Australian and European models.

As ferry transportation surges in the United States, maritime policy which requires vessels in domestic trade to be U.S.-built has effected a transfer of technology and state-of-the-art designs to domestic shipyards. The Merchant Marine Act of 1920, also known as the Jones Act, requires a reliable and secure merchant marine sealift that is responsible only to U.S. control and immune to control by foreign interests.

The Jones Act requires that vessels trading between U.S. ports be built in U.S. shipyards, manned by U.S. citizens, sailed under the American flag, compliant with U.S. laws and regulations, and subject to U.S. taxes. Austal Ships, of Australia, has gone so far as to build a new shipyard in Mobile, Alabama, for fast ferry and similar vessel construction.

Australian Experience

Incat Australia[1] is the world s leading producer of high-speed passenger and vehicular ferries. Since 1990 Incat has built 33 vehicle ferries of more than 70 meters (230 feet) in length; this constitutes almost 40 percent of the world s high-speed, large-capacity ferry market.

[1] www.incat.com.au.

The company s first passenger and vehicle ferry was delivered in 1990 a 74-meter (243-feet) wave-piercing catamaran with a deadweight capacity (cargo plus stores) of 200 tons. Incat s *Evolution*, a passenger vessel with roll-on, roll-off access, is a 112-meter (367-foot) wave-piercing catamaran that can travel at 40 knots. The high-speed ferry has a deadweight capacity of 1,000 tons and vehicle deck capacity of 589 truck lane-meters (0.3 lane-miles) and 50 cars or a total capacity of 312 cars (*2*).

In May 1999, the Royal Australian Navy commissioned the Incat-built passenger-and-vehicle ferry *HMAS Jervis Bay* for operations between Darwin and East Timor. The application demonstrated the viability of high-speed, lightweight, multihull craft for military use (*2*).

Going Military

The U.S. Coast Guard defines fast ferries as vessels that operate at speeds of more than 25 knots. The majority of fast ferries are twin hull, or catamarans, with water-jet propulsion and diesel engines. Variations include single-hull vessels, screw or propeller propulsion, and gas turbine engines.

With the rapid advance of commercially viable fast ferries, and pressure to optimize military budgets by adapting commercial off-the-shelf technologies, several projects have developed to place fast ferries in military roles. Sealift is a natural application; also under consideration are the transport of special operations forces into coastal waters, surveillance and command-and-control missions, and mine warfare.

Fast ferry projects under way in the military include the theater support vessel (TSV) program, the littoral (or shoreline) combatant ship program, and the Navy s X-craft catamaran program. Of these, only the TSV program is trying out off-the-shelf fast ferry vessels (*3*).

Westpac Express, a high-speed catamaran designed for roll-on, roll-off access, is chartered to the Third Marine Expeditionary Force.

[2] www.austal-ships.com.

Theater Support Vessels

The TSV program attempts to fill the gap between landing craft and large amphibious lift ships. Four catamaran fast ferry vessels, designed and built in Australia, are in deployment by all major services of the U.S. military. The 101-meter (331-foot) *Westpac Express* is from Austal Ships. The 96-meter (314-foot) *Joint Venture* HSV-X1, the 98-meter (321-foot) *Spearhead* TSV-1X, and the 98-meter *Swift* HSV-X2 are wave-piercing catamarans from Incat. The *Joint Venture* and the *Spearhead* were employed commercially beforehand.

Westpac Express

In July 2001, Austal Ships[2] leased the *Westpac Express* to the U.S. Marine Corps to demonstrate the effectiveness of commercial high-speed ships for rapid deployment of troops and equipment. In January 2002, the Navy s Military Sealift Command awarded a $31 million, 36-month contract to Austal Ships to operate a high-speed catamaran for the Third Marine Expeditionary Force.

The *Westpac Express* can sustain a speed of 33 knots fully loaded with 970 passengers and 2973 square meters (32,000 square feet) of cargo. The ship can carry an entire reinforced battalion of Marines and their equipment, obviating the need to fly the troops separately and match up with the equipment on site, and freeing up as many as 10 military airplanes and 1 ship for other purposes. With a shallow draft of only 4.25 meters (14 feet), *Westpac Express* can operate in a variety of ports (*4*).

Joint Venture

In 2001, the U.S. military leased an Incat-built 96-meter high-speed, wave-piercing catamaran *Joint Venture* HSV-X1 from Bollinger—Incat USA,[3] for up to 2 years at a cost of $20.5 million (*5*). Built in 1998 as a commercial vehicle-and-passenger high-speed ferry, the *Joint Venture* had operated in New Zealand s rugged Cook Strait and in Australia s Bass Strait. Powered by four marine diesel engines developing 7200 kW each, the vessel underwent 6 weeks of technical and structural modifications before military use, including installation of a two-part hydraulically-operated ramp for rapid loading and discharging of vehicles from the stern or alongside and a pad suitable for large helicopters (*6*).

Goals include the rapid movement of more than 450 tons of cargo and more than 325 personnel for more than 1,100 nautical miles at an average speed of 35 knots in Sea State 3 (that is, with small waves of 1.4 to 2.9 feet high). *Joint Venture* can carry 363

[3] www.bollinger-incatusa.com.

PHOTO: PAUL FARLEY, U.S. NAVY

Multiservice high-speed vessel *Joint Venture* approaches port in Souda Bay, Crete.

persons, with military vehicles and equipment, for more than 1,110 nautical miles at a speed greater than 35 knots.

The main vehicle deck has an unrestricted height of more than 4.25 meters (14 feet) and a width of 23 meters (75 feet). With a draft of less than 4 meters (13 feet), the ferry can access ports unavailable to conventional ships, boosting the boat s flexibility and mission options.

The Incat vessel also must be able to launch and recover helicopters and rigid inflatable boats in Sea State 3. Alternatively, a deadweight cargo capacity of approximately 570 tons for 966 kilometers (600 statute miles) is required. Without a heavy load, the ferry can travel at 48 knots. *Joint Venture* s shallow 3.6-meter (12-foot) draft also allows maneuvering in shallow waters (*6*).

Multiservice Experiment

The *Joint Venture* program is a multiservice experiment that includes the Navy Warfare Development Command; the U.S. Army Transportation Center; the Special Operations Command; the Combined Arms Support Command; the U.S. Marine Corps Plans, Policy and Operations; the Office of Naval Research; Naval Sea Systems Command and Naval Air Systems Command; and the U. S. Coast Guard Deepwater Project.

Concepts to be considered include

- Simultaneous deployment and employment of the military force,
- Fight on arrival,
- En route mission planning and rehearsal,
- Passengers and equipment moving together,
- Bypassing strategic and operational chokepoints, and
- Entry at multiple points.

Missions to be considered include sealift, replenishment and resupply at sea, special operations insertion and redeployment, reconnaissance, command and control, antisubmarine warfare, mine warfare, humanitarian assistance and evacuation, surface warfare, and force protection.

Seeing Action

The war against terrorism changed the experimental status of the *Joint Venture* project. The vessel departed from Norfolk, Virginia, on January 25, 2003, for its first operational deployment (*7*). After crossing the Atlantic, the ship operated in the Arabian Gulf.

Joint Venture was charged with supporting various operations and functioned as the command and control platform for the U.S. Navy SEALs (Sea, Air, and Land Forces). *Joint Venture* also transported various military units that were training for vessel-boarding search and seizure during Operation Iraqi Freedom (*8*).

Joint Venture cruises at 35 to 40 knots, delivering troops and equipment almost four times as fast as the Army s conventional logistics support vessel (LSV), which has a speed of 11.6 knots (*9*). The LSV, however, has a superior cargo capacity, with a total deadweight of 2,864 short tons, and can carry up to 900 short tons during logistics-over-the-shore operations and up to 2,000 short tons for missions within a theater of military operations (*10*). The *Joint Venture* has a total deadweight of 849 short tons.

Spearhead

The second Incat-built high-speed ferry to enter U.S. military service was the 98-meter (321-foot) wave-piercing catamaran *Spearhead* TSV-1X. The *Spearhead* is an all-Army endeavor, operated by the 469th Transportation Detachment, Fort Eustis, Virginia. *Spearhead* has a 9-year civilian past as a high-speed ferry between the Australian mainland and Tasmania (*11*).

The U.S. Army s TSV program is part of the Advanced Concept Technology Demonstrator Program of the Office of the Secretary of Defense and the U.S. Army. *Spearhead* is the first of perhaps 17 $85-million vessels to be built for the U.S. Army and is a critical element of the Army s Title 10 intratheater mission.

The TSV will be used for sustainment deliveries, as well as for the movement of troop units and stocks. Delivering troops and equipment within a theater reduces the need for a large-scale on-shore reception, staging, and onward movement and integration of troops, vehicles, and equipment in the battle area.

Like the *Joint Venture*, *Spearhead* was deployed to the Iraqi theater. Missions have included hauling two Patriot missile battalions from Qatar to the naval base in Kuwait, working in conjunction with the

PHOTO: BRIEN AHO, U.S. NAVY

U.S. Army theater support vessel *Spearhead* departs from port.

LSVs in theater. The TSV also moved the 101st Airborne Division military police from Djibouti to Kuwait, making the 3220-kilometer (2,000-mile) trip in 2.5 days. The LSV would have required 10 days for the voyage, carrying only the equipment; the troops would have traveled by air.

Swift

Incat recently completed another catamaran for the Navy. An evolution from the *Joint Venture*, the 98-meter (321-foot) *Swift* HSV-X2 is leased to the Military Sealift Command, operated by the U.S. Navy Mine Warfare Command, and stationed in Ingleside, Texas. The *Swift* has a 2601-square-meter (28,000-square-foot) mission deck and vehicle ramp, a 372-square meter (4,000-square-foot) flight deck, and a boat crane (*12*).

Missions will include maritime interdiction, mine warfare, littoral access, homeland security, and expeditious troop and equipment transport. Some envision the ship as a stepping-stone to the littoral combatant ship, a relatively small, next-generation, focused-mission combat ship now in conceptual design.

Littoral Combatant Ships

The littoral combatant ship program is a major new Department of Defense initiative that may build on high-speed ferry technology or on alternative technologies such as carbon-fiber trimaran hulls, semi-planing monohulls, or hybrid catamaran—surface effect ships. The mission priority is speed 40 knots at minimum, with higher speeds preferred. Payload and modularity are other goals. A sprint-speed range of 1,000 to 1,500 nautical miles and a cruising range of 3,500 to 4,300 nautical miles also are necessary.

The littoral combatant ship will deploy a military helicopter and carry smaller rigid inflatable boats. The payload has a threshold of 180 metric tons and an objective level of 210 metric tons. The Navy is expected to build a minimum of 30 littoral combatant ships at a nominal cost of $200 million per unit, starting in 2005.

The U.S. Navy X-craft catamaran is under construction at Nichols Brothers Boat Builders[4] in Freeland, Washington. Nichols Brothers is also a U.S. licensee of Incat, and has built many Incat-designed fast ferries. Another veteran designer of fast ferries, Nigel Gee and Associates[5] of Southampton, England, is responsible for the design and engineering of the X-craft.

The 81-meter (266-foot) vessel is powered by a pair of gas turbines with 33,500 horsepower each and a pair of 4,000-horsepower diesel engines a total of 75,000-horsepower driving four water-jet propulsors, to achieve a top speed of more than 50 knots (*13*). The low-profile vessel will have two decks: a flight deck for two large on-board helicopters, and a cargo deck for troops, vehicles, or up to 12 shipping containers. Other features include a cargo elevator and a stern ramp for roll-on, roll-off vehicle operations or for deployment of rigid inflatable boats at sea (*14*). The X-craft may be able to satisfy most of the Navy s littoral combatant ship requirements.

Next Ports of Call

Commercial fast-ferry technology first attracted the U.S. military with moderate costs, high speed (more than 45 knots), long range (more than 4,000 nautical miles at 30 knots), good seakeeping ability [30 knots in 4.5- to 5-meter (14.8- to 16.4-foot) seas], generous payload (750 tonnes), shallow draft [3.7 to 4.3 meters (12 to 14 feet)], and modular adaptability (*15*). As the military applications of these vessels develop, technological advances and refinements will be added, such as composite construction, more efficient hull forms and propulsion systems, and increased modularity.

These features may transfer back to the commercial venue. For example, military modular adaptability enhancements could transform fast commuter ferries to carry containerized high-value cargo (such as overnight package shipments) during off-peak hours or to serve as dinner boats in the evening.

The U.S. military s embrace of fast ferry technology is expected to increase. Fast ferries proved their mettle to the Royal Australian Navy in the East Timor conflict. The *Joint Venture* and the *Spearhead* have served in Operation Iraqi Freedom, ferrying supplies and troops, as well as participating in combat support operations.

[4] www.nicholsboats.com.
[5] www.ngal.co.uk.

Technical Challenges of Fast Ships for the U.S. Navy

MALCOLM MacKINNON

The success of some commercial fast ferry designs and technologies has fueled an interest in achieving high speeds in the next generation of naval ships. Some commercial fast ferries already have been adapted for naval use. The U.S. Navy would like to reach speeds of 50 knots, which any naval architect knows are not achieved without difficulty.

High-speed ships have many virtues but also present several drawbacks:

- **Performance on the open ocean in high sea states.** In the open ocean, ship motions depend on both short chops and long swells. The extreme heave-and-pitch of head seas can slam the cross structure of multihull ships. Moreover, multihull ship motions in following and quartering seas can produce seasickness.
- **Structural integrity.** Extreme motions, particularly on multihull ships, produce high local stresses. High-speed vessels use nonsteel hull materials such as aluminum and composites to reduce weight. These materials tend to develop local stress cracking, and aluminum may undergo stress corrosion.
- **Speed at the expense of range and payload.** A designer of high-speed ships must consider fuel consumption at high power levels. The fuel carried must be sufficient for a given range. Increased fuel leads to a decrease in cargo or payload capacity. Increasing the hull size requires more power to achieve the same top speed, in turn requiring larger machinery with added volume and weight.
- **Reliability.** The reliability of high-speed ships remains to be proved for the extended overseas deployment required of naval warships. The high-speed, high-performance ships of the hydrofoil PHM (guided missile patrol boat) class, for example, required more Navy personnel shoreside for maintenance than for manning and operating the vessels.

Pursuing high speed as a principal characteristic of ships poses challenges for Navy technology, research, and dedication.

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The Army has budgeted for seven TSVs and is preparing a request for proposals. Additional military orders of the vessels are expected, which will nurture fast ferry shipbuilding in the United States. The fast ferry TSV may become the surrogate littoral combatant ship, in an even broader transfer of technology. Fast ferry versatility, reliability, speed, and cost give the technology a prominent role in transforming the U.S. military fleet of the 21st century.

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WEIGH-IN-MOTION TECHNOLOGY for Military Operations

Developing a Portable, Safe, and Accurate System

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Weighing vehicles and other cargo before loading them onto aircraft in a theater of operations is critical to the deployment of U.S. military forces. Rolling stock and other cargo must be weighed and measured accurately to calculate the center of balance of each item for proper distribution of weight in the aircraft. The weighing and measuring are vital to the safety of the aircraft, the crew, and any passengers. Errors can be fatal.

In-ground static scales for weighing are available at most air bases in the United States, but not in remote or undeveloped areas. In June 2002, a special operations combat supply plane crashed in Afghanistan, killing several crew members. U.S. Air Force accident investigators concluded that the crash was caused by imprecise information about cargo weight combined with a get the job done attitude.

The aircraft crashed because it was overweight for the location, 7,200 feet above sea level. *Army Times* reported that weighing cargo at such isolated airstrips was not practical the Air Force special operations crews were relying instead on weight estimates (*1*).

Nevertheless, military procedure requires all equipment to be weighed before loading, without guesswork or estimates. The unit in Afghanistan had estimated a weight that was wrong by several thousand pounds. Each location requires specifically recalculating the cargo s weight and center of balance and taking into account the effects of altitude, temperature, runway length, and aircraft type.

U.S. military forces today are deployed globally and rapidly, often in areas with little infrastructure, rarely including an in-ground static weigh scale. New technologies are addressing this problem.

Tools in Hand

If an in-ground fixed weigh scale is not available for wheeled vehicles, individual wheel-weigh manual portable scales and tape measures are used to weigh military equipment and to determine the center of balance. Individual wheel-weigh scales are placed under each wheel, and all wheels must be on the scales at the same time, to ensure accuracy.

Demonstration of weigh-in-motion (WIM) at Fort Bragg, North Carolina, May 2003, with truck moving over portable system.

After weighing the individual wheels or wheel sets, the next step is to measure the distance between the axles and calculate the center of balance, the individual axle weights, and the total vehicle weight. The Air Force loadmaster uses the center-of-balance data and total vehicle weight to plan a specific load for each aircraft.

The process is time-consuming, exhausting, and prone to error, especially in adverse weather. Placing the individual wheel-weigh manual portable scales under the wheels of the vehicle also presents a safety hazard. The process requires 6 to 10 soldiers. The loadmaster uses the data to determine the safe loading of the aircraft. No Air Force pilot will take off without clearance from the loadmaster.

Improved Systems

Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee, has been experimenting with and developing portable weigh-in-motion (WIM) systems for

more than 10 years. ORNL developed its first system for the verification program of the U.S.—Soviet missile disarmament agreement, to identify and verify the weights of missiles moved from production facilities, assembly plants, and deployment bases, or to destruction sites.

WIM systems have highway applications for commercial vehicles at low and high speeds. In the early 1990s, the Air Force Productivity, Reliability, Availability, and Maintainability Office commissioned ORNL to develop a portable WIM system for military deployment.

The military needed a tool that could weigh and determine the center of balance for wheeled vehicles and cargo, providing the data electronically for deployment, redeployment, and other inter- and intratheater activities. ORNL developed a system to register individual wheel weights, axle weights, axle spacing, total vehicle weight, and center of balance, regardless of the total number of axles.

The benefits of the WIM technology are many. The system offers portability, reduces labor, increases productivity, and eliminates human errors in transferring data and making calculations. In addition, portable WIM enhances deployability and reduces the logistics footprint with fewer items of equipment, so that the military can react quickly and effectively to any need.

The WIM system has commercial applications as well. State enforcement agencies could use portable units for random weight checks of commercial vehicles on highways and state roads where static weighing scales are not available. Additional industrial applications would include weighing trucks at facilities to assure proper weight distribution for safe travel.

The WIM system also may have applicability in response to the National Transportation Safety Board s February 2004 recommendation that federal regulators and the airlines develop methods to weigh passengers and baggage to prevent overloading of airplanes (*2*). The safety board had concluded that the crash of Air Midwest Flight 5481 on January 8, 2003, was caused by too much weight in the rear of the aircraft combined with a maintenance mistake.

Inside the Technology

The portable WIM system weighs and records individual axle weights, measures and records the spacing between axles, and automatically determines the vehicle s total weight, individual wheel weights, individual axle weights, individual axle spacing, and longitudinal center of balance. The system improves the weighing process by reducing personnel hours and the time required for deployment and by eliminating opportunities for human errors from the manual transfer of data or from the miscalculation of vehicle attributes.

Weight data are measured as each wheel rolls over the system, which uses two to six transducer pads. By using the front wheels as a trip indicator and the last wheel to end the cycle, the system can collect and calculate the parameters automatically (see Figure 1).

All calculations are completed electronically in real time. The data can be relayed to the military s databases for deployment decision making, such as the Transportation Coordinators Automated Information for Movement System II or the Automated Air Load Planning System.

Comparison Tests

Several side-by-side tests have been performed at Fort Bragg, North Carolina, and other bases to compare the portable WIM system with the weighing technologies now in use by the military that is, with the in-ground static weigh scale used at home bases and with the individual wheel-weigh scale system used in

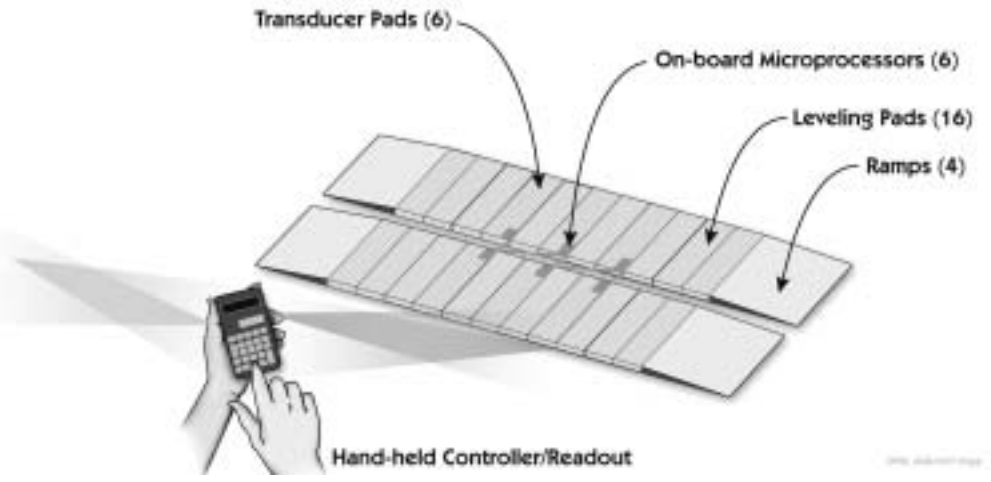

FIGURE 1 Typical new WIM system design.

TABLE 1 Average Times for Vehicle Preparation with Different Scales

Static scales with tape measure	Individual wheel-weigh scales with tape measure	Portable WIM system
7 minutes, 38 seconds	7 minutes, 46 seconds	3 minutes, 3 seconds

remote locations. The portable WIM demonstrated significant savings in time and labor and eliminated errors in manual entry and calculation.

A test compared the portable WIM with a commercial individual wheel-weigh scale system at Ft. Bragg in late 1996, weighing and determining the longitudinal center of balance of a 5-ton truck, a 2.5-ton truck, a 1-ton truck, and a tractor with a 40-foot trailer. The individual wheel-weigh scales weighed the vehicles and calculated the center of balance for the five vehicles in 25.3 minutes; the portable WIM system did the same in 4.4 minutes. Operating the portable WIM system required only three soldiers; the other method required at least eight soldiers to maintain speed in data processing.

A second set of tests in May 2003, again at Ft. Bragg, weighed and determined the center of balance of 23 vehicles and 1 container in a simulated deployment. The military vehicles included a high-mobility multipurpose wheeled vehicle, 5-ton wreckers, tractors with flatbed trailers, 5-ton vehicles with trailers, and a forklift.

The static weigh scale and tape measure technique required three operating personnel; the individual wheel-weigh scales and tape measure technique required seven; and the portable WIM system required three. The average times required to weigh, measure, determine the center of balance, and mark the individual vehicles are shown in Table 1.

The number of axles caused great variations in times for the static in-ground weigh scale and the single wheel-weigh scales. The portable WIM system consistently registered the same times, regardless of the number of axles.

Human errors in the calculations of vehicle attributes were 9 percent for the static weigh scale and tape measure technique; 14 percent for the individual wheel-weigh scales and tape measure technique; and zero for the portable WIM system. The tests were performed in excellent weather conditions, but in rain, snow, or high winds, the human error rate would be expected to increase for the first two techniques.

The main advantage of the portable WIM is the reduction of potential errors. The individual wheel-weigh scales and the static scales require the transfer of data from one device to another, as well as the manual calculation of individual axle weights, total vehicle weight, and center of balance. ORNLs portable WIM system will eliminate manual calculations and will feed the data directly into other systems for the automated management of deployment and load planning. The system also will free up military personnel to do other jobs.

Next Steps

ORNL is enhancing the portable WIM system with a new algorithm for accuracy of weighing, along with upgraded electronics, modifications for field use, interfaces to the databases for military deployment, and a capability to identify automatically the vehicle or cargo being weighed. State-of-the art load cell transducers and optimized spacing will maintain accuracy within 1 or 2 percent.

Although the system can be assembled and handled easily in the field by two soldiers, another focus is on trimming the weight for easier handling and assembly perhaps with lightweight but strong composites. The objective is to develop a field-rugged system that can go anywhere the military deploys and that can weigh vehicles and cargo safely, provide the data automatically to all authorized systems and users, and be transported in the back of the last vehicle to be loaded.

In the Toolkit

WIM systems have been available in the commercial vehicle industry and enforcement services for more than a decade, with wider applications in Europe. If the portable version had been available to soldiers sooner, the fatal accident in Afghanistan might not have occurred.

The new portable WIM system will eliminate human errors in data entry and in calculations, increase speed and productivity in deployments, eliminate the need for a static weigh scale, support rapid force movement, and reduce costs. The system can go anywhere via aircraft and can be set up and operating in a few minutes. With portable WIM in the toolkit, soldiers will perform missions more efficiently, more accurately, and in greater safety.

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TRB 2004

ANNUAL MEETING HIGHLIGHTS

RENEWAL, SECURITY, FUNDING AND MORE

2004 Annual Meeting Spotlights Research Goals and Achievements

More than 9,000 transportation researchers, practitioners, and administrators representing government, industry, and academia from the United States and abroad gathered in Washington, D.C., January 11–15, 2004, to participate in the 83rd Annual Meeting of the Transportation Research Board. The five-day program, including more than 2,400 presentations in 500 sessions, 55 specialty workshops, 350 committee meetings, exhibits, and meet-the-author poster sessions offered attendees a variety of opportunities for information sharing and interaction. Three spotlight themes—Renewing the Transportation Infrastructure; Security: Measures That Can Make a Real Difference; and Funding: Reauthorization and Beyond—tied many of the diverse program sessions together. Details and highlights appear on the following pages.

Annual Meeting photography by Cable Risdon Photography

The Annual Meeting sessions were developed by the approximately 200 standing committees in TRB's Technical Activities Division. These committees have been reorganized into a new collection of Groups and Sections, enhancing the ability to address a variety of specific and crosscutting issues in transportation research. The TRB Technical Activities Division Council, which expanded to 11 group chairs with the reorganization, met midday Sunday (*left to right*): Freight Systems: Christina Casgar, U.S. DOT; Legal Resources: Brelend Gowan, California DOT; Marine: Larry Daggett, Waterway Simulation Technology, Inc.; Operations and Maintenance: Jonathan Upchurch, U.S. House of Representatives Transportation and Infrastructure Committee; Aviation: Agam Sinha, MITRE Corporation; Planning and Environment: Neil Pedersen, Maryland State Highway Administration; Council Chair Anne Canby, Surface Transportation Policy Project; Public Transportation: Patricia McLaughlin, Moore Iacofano Golstman, Inc.; System Users: Barry Sweedler, Safety & Policy Analysis International; Design and Construction: Gale Page, Florida DOT; Policy and Organization: Katherine Turnbull, Texas Transportation Institute; Rail: Christopher Barkan, University of Illinois; Division Director Mark Norman; and Management and Leadership Section: Robert Johns, University of Minnesota.

Charles Howard, Washington State DOT (*left*), and Lance Neumann, Cambridge Systematics, Inc., chat before the Technical Activities Division All Chairs Meeting.

Richard Compton, National Highway Traffic Safety Administration (NHTSA), discusses risk factors for aggressive driving during a Human Factors Workshop.

Human Factors Luncheon keynote speaker Lois Thibault, U.S. Access Board, sits with Gihon Jordan, Philadelphia Department of Streets.

Planning Committee for the 37th Annual Human Factors in Transportation Workshop, which drew nearly 200 people to 9 all-day sessions (*left to right):* Gregory Davis, Federal Highway Administration (FHWA); Christopher Monk, NHTSA; Neil Lerner, WESTAT, Inc.; Thomas Raslear, Federal Railroad Administration (FRA); Richard Schwab, consultant; Fred Hanscom, Transportation Research Corporation; Harvey Sterns, University of Akron; Helmut Zwahlen, Ohio State University; Gihon Jordan, Philadelphia Department of Streets; Richard Pain, TRB Transportation Safety Coordinator; and Alexander Landsburg, U.S. Maritime Administration (MARAD).

Jeffrey Shane, Undersecretary of Transportation for Policy, leads administrators of the U.S. DOT in a panel discussion about the future role of the federal government in technology, transportation infrastructure renewal, financing, intermodal connectivity, freight movement, increasing productivity, aviation management, water transport, energy, and environmental programs. *From left:* Samuel Bonasso, Research and Special Programs Administration; Jeffrey Runge, NHTSA; Mary Peters, FHWA; Annette Sandberg, Federal Motor Carrier Safety Administration; Shane; Emil Frankel, U.S. DOT; Allan Rutter, FRA; Jennifer Dorn, Federal Transit Administration (FTA); Deputy Administrator Robert Sturgell, Federal Aviation Administration (FAA); William Schubert, U.S. MARAD.

A well-attended session, presided over by Barbara Sisson, FTA, featured discussion on the importance of cost–benefit analysis in selecting the appropriate technology for transit bus applications. Participants described the decision-making process involved in selecting transit technology to meet a system's operational and business needs. The session highlighted current FTA efforts to compile information and insights from the bus rapid transit initiative that can help local planners and officials contemplating BRT for solving local community transportation problems.

Staff members from the U.S. House of Representatives and the U.S. Senate provided their prognostications on when reauthorization of federal-aid transportation programs may arrive, what it may include, and issues that will need to be addressed. Jeff Squires, Senate Environment and Public Works Committee; Sarah Kline, Senate Banking Committee; and Debbie Hersman, Senate Commerce Committee, share a light moment during the panel discussion. (Not pictured: House Transportation and Infrastructure Committee staff members Jonathan Upchurch, presiding, Clyde Woodle, and Joyce Rose.)

(*Left to right*): Richard de Neufville, Massachusetts Institute of Technology (MIT); Jasenka Rakas, University of California–Berkeley, presiding; Agam Sinha, MITRE Corporation; Herman Rediess, FAA; and Robert Jacobsen, National Aeronautics and Space Administration, examine present and future aviation research and development. The renewal spotlight session focused on worldwide airport design challenges, new technologies, and methodologies and concepts developed for the National Airspace System.

Doctoral Student Research in Transportation Geotechnics Workshop provided recent and upcoming geotechnical Ph.D. students the opportunity to showcase their research. Yanfeng Li, Texas A&M University, presents his paper, "Breakaway Cable Terminal as a New Instrument for Quick Evaluation of Compaction."

William Withuhn, Smithsonian Institution, presides over a session recognizing the centennial achievements of American Automobile Association, Ford, Buick, and Harley-Davidson. Presenters examined the innovations in transportation that propelled these organizations at the beginning of the last century.

The Blue Ribbon Panel on Bridge and Tunnel Security presented strategies for improving security after September 11, 2001, and offered design guidance for highway bridge and tunnel infrastructure: (*left to right*) John Gerner, FHWA; Jeremy Isenberg, Weidlinger Associates; Henry Hungerbeeler, Missouri DOT; James Roberts, consultant; Joseph Englot, Port Authority of New York and New Jersey; John Kulicki, Modjeski and Masters, Inc.; George Clendenin, Virginia DOT; James Cooper, consultant; Steven Ernst, FHWA; Mary Lou Ralls, Texas DOT; and Harold Rogers, Jr., Pennsylvania DOT.

From left: William Black, National Security Agency; Daniel O'Neil, CRADA International, Inc., presiding; Robert Gallamore, Northwestern University; and Yacov Y. Haimes, University of Virginia, participate in spotlight workshop designed to raise awareness about cyberterrorism and cybersecuirty by examining information assurance and the interdependencies of transportation modes. The workshop concluded with an interactive forum to identify current initiatives and options available to the transportation community. (*Not pictured*: Lindor Henrickson, Science Applications International Corporation, presiding.)

Alfonso Martinez-Fonts, Jr., U.S. Department of Homeland Security, discusses cost–benefit analysis of hazardous materials transportation security at a session on Wednesday.

Alternative freight corridor planning, development, funding, and management are rapidly emerging freight issues; however, the tools available to support the development of alternative corridors are still in the early stages of development. Emil Frankel, U.S. DOT, discusses efforts to fund alternative freight capacity, including rail and water options, during a funding spotlight session.

Roger Clarke, Alberta Vehicle Safety and Carrier Services, Canada, discusses international examples of motor carrier safety during a session on efforts at self-regulation in the trucking industry.

Panelists for session addressing freight–community relations, (*left to right*): Steven Eisenach, Norfolk Southern Corporation; Anne Strauss-Wieder, consultant; Stacey Jones, Port of Los Angeles; Margaret Campbell Jackson, Howard/Stein-Hudson Associates, presiding; Richard Hollingsworth, Gateway Cities Partnership, Inc.

Conrad Ruppert, Amtrak, speaks about track upgrade for high-speed and heavy-axle load trains at a session on advances in railway design, construction, and maintenance. Other rail sessions focused on railroad investment, particularly public investment in private rail infrastructure.

Toshiyuki Yokota, World Bank, presents research on "Roadside Rest Areas: Road Infrastructure to Raise Regional Economy and Empower Communities," during a session on Traffic Operations and Design in Asia.

A panel of National Transportation Safety Board officials discussed a list of most-wanted safety improvements, including medical certification of commercial vehicle operators, increasing bus crashworthiness, positive train control, enhanced vehicle recording devices, preventing runway incursions, and reducing hard-core drinking and driving. Panelists included (*from left*): Joe Osterman, Sandy Rowlett, Bob Chipkevich, Chairman Ellen Engleman Conners, Kevin Quinlan, and Jim Cash. (Not pictured is Mitchell Garber.)

Govert Sweere, Netherlands Ministry of Transport, presides over session on innovations in pavement rehabilitation and maintenance. Other topics covered in Pavement Management sessions included rigid and flexible pavement design, pavement strength and deformation characteristics, pavement monitoring and evaluation, and pavement surface properties.

POSTERS &

Meeting participants peruse the exhibit for Rutgers University's Center for Advanced Infrastructure & Transportation, detailing multimodal transportation infrastructure systems research.

The Exhibit Hall at the Marriott housed recent research projects and products of TRB sponsors and sustaining affiliates. *Above*: the American Association of State Highway and Transportation Officials (AASHTO) publications exhibit.

The National Crash Analysis Center, a collaborative effort between George Washington University, FHWA, and NHTSA, showcases automotive and highway research at its exhibit.

Hiromitsu Yajima, Institute of Behavioral Sciences, shares his research, "Yokohama North-West Corridor Project," with Linda Weaver Beacham, Schemmer Associates, during the Public Involvement Poster Session at the Shoreham.

Meet-the-Author Poster Sessions at all three hotels provided participants with an opportunity to interact with authors in a more personal setting than the conventional lecture. Above: The well-attended Environmental Mega Poster Session at the Washington Hilton. Below: Mark Muriello, Port Authority of New York and New Jersey, explains traffic management results from value toll pricing.

From left: David Boyce, Northwestern University, meets with Natacha Thomas and Xiaozhao Lu, University of Rhode Island.

From left: Public Transportation Section Chair Patricia McLaughlin, Moore Iacofano Golstman, Inc., provides information about TRB committees to MIT students Michael Hanowsky and James Sorensen.

First-ever undergraduate recipient of the Eisenhower Grant, Jason West, University of Texas–San Antonio, meets with Jeff Keaton, AMEC Earth & Environmental, Inc. and Chair of Geology and Properties of Earth Materials Section, during the New and Young Attendees Welcome and Networking Reception. After a short presentation on how to navigate the meeting, newcomers mingled with committee chairs present.

Colleagues page through Annual Meeting Final Program to strategize which sessions to attend.

Vijay Kornala, Kansas State University, reviews recruitment materials with Jeffrey Smithline, URS Corporation, in the Employment Room in the Marriott.

From left: James Bonneson, Texas Transportation Institute (TTI); Jake Kononov, Colorado DOT; and Karl Zimmerman, TTI; view research on a laptop.

Andreia Simoes and Margarida Coelho of Portugal read through materials before the New and Young Attendees Welcome and Networking Reception.

James Crites, Dallas–Fort Worth International Airport (*right*), talks with TRB Senior Program Officer Thomas Menzies, during the Aviation Chairs Lunch on Tuesday.

CHAIRMAN'S LUNCHEON

The program for the Chairman's Luncheon, hosted by 2003 Executive Committee Chair Genevieve Giuliano, included the introduction of new Executive Committee members and officers, an address by featured speaker David Billington, Princeton University, and presentation of TRB's most prestigious awards.

E. Dean Carlson, Carlson Associates, accepted the W. N. Carey, Jr., Distinguished Service Award for his outstanding leadership and service to transportation research and to TRB. Throughout his career, the former FHWA Executive Director and Kansas Secretary of Transportation has championed the importance of research in improving the performance, cost effectiveness, and safety of the nation's highway system. A strong supporter of TRB programs, Carlson has bee active in TRB for more than 20 years and served as Executive Committee Chair in 2002. He has contributed to both the original and Future Strategic Highway Research Program. He was elected to the National Academy of Engineering in 2001.

Alan Altshuler, Harvard University, received the Roy W. Crum Distinguished Service Award for his significant contributions to research on transportation planning and policy. A noted political scientist, Altshuler served as Massachusetts' first Secretary of Transportation and Construction. Through his seminal books, such as *The City Planning Process*, *The Urban Transportation System: Politics and Policy Innovation*, and *Mega-Projects: The Changing Politics of Urban Public Investment*, he has cast new light on the transportation decision-making process. He served on the TRB Executive Committee from 1985 to 1988.

Shirley Clair McCall, Cardozo Senior High School, Washington, D.C., was honored with the Sharon D. Banks Award for Innovative Leadership in Transportation for her outstanding accomplishments in transportation education. McCall coordinates the Transportation and Technology Academy (TransTech) at Cardozo in an effort to encourage inner-city students to consider higher education, employment, and careers in transportation. TransTech provides students with mentoring, summer internships, regular student work assignments, and career development activities. McCall, who helped found TransTech in 1991, has set high academic standards; 85 percent of the more than 200 students who have completed the program have gone to college.

Princeton Engineering Professor Provides a Lesson in Bridge Design

David Billington, Gordon Y. S. Wu Professor of Engineering at Princeton University, presented a multimedia lecture on the history and aesthetics of bridge design as the featured speaker at the Chairman s Luncheon. Billington employed a lively slide show and a quick wit to narrate bridge construction during the past 250 years. He urged the continued use of innovative design and construction techniques and called on attendees to view bridges as works of art.

Billington has served as a member of the Princeton faculty for more than 40 years and as director of the university s Program on Architecture and Engineering since 1990. A pioneering educator and author, Billington has taught undergraduate and graduate courses in structures to engineers and architects and has introduced three permanent introductory courses on engineering at Princeton. One of these, Structures and the Urban Environment, has been offered regularly since 1974 and frequently has had the highest enrollment of any course offered by the School of Engineering and Applied Science, attracting large numbers of liberal arts students. This course, which was the basis of his lecture, considers structural engineering as an art form parallel to, but independent from, architecture.

His lectures and teaching exhibitions have earned him national and international recognition. The title of one of the teaching exhibits neatly summarized Billington s main theme: The Interaction of Engineering and Politics Has Transformed the United States over the Past 250 Years. This theme has unfolded in a series of major books, including *The Tower and the Bridge: The New Art of Structural Engineering*, *The Innovators: The Engineering Pioneers Who Made America Modern*, three books on the work of Robert Maillart, and *The Art of Structural Design: A Swiss Legacy*. Billington is widely recognized for his contributions to the design of thin-shell concrete structures, the subject of an early book.

Recipient of many awards, Billington received the National Science Foundation Director s Distinguished Teaching Scholar Award in 2003. He was elected to the National Academy of Engineering in 1986, and more recently was elected a Fellow of the American Academy of Arts and Sciences, an Honorary Member of the American Society of Civil Engineers, and an Honorary Member of the American Concrete Institute.

David Billington met personally with Cardozo Senior High School students in the TransTech program. Their program coordinator, Shirley McCall, 2003 recipient of the Banks Award, is in the background, *left*.

From left: 2003 Woods Award winners McVay, Consolazio, and Lehr; 2003 Burggraf Award winner Vandenbossche; Technical Activities Council Chair Anne Canby; 2003 TRB Executive Committee Chair Genevieve Giuliano; and 2003 Mickle Award winners Lord, Lyon, McGee, and Persaud.

Award-Winning Papers in Print

During the Chairman s Luncheon, awards were presented to the outstanding papers published in the 2003 series of the *Transportation Research Record: Journal of the Transportation Research Board.* The K.B. Woods Award for the outstanding paper in the field of design and construction of transportation facilities was presented to Gary Consolazio, G. Benjamin Lehr, and Michael McVay of the University of Florida for their paper, Dynamic Finite Element Analysis of Vessel-Pier-Soil Interaction During Barge Impact Events. Published in *Transportation Research Record No. 1849*, the paper describes dynamic tests for computing lateral impact loads necessary for highway bridge design.

The Fred Burggraf Award recognizes excellence in transportation research by researchers 35 years of age or younger whose papers have been published under the sponsorship of any Technical Activities Division standing committee. The 2003 recipient, Julie Vandenbossche, University of Pittsburgh, authored Performance Analysis of Ultrathin Whitetopping Intersections on US-169: Elk River, Minnesota, published in *Transportation Research Record No. 1823*. The study endorsed ultrathin whitetopping as a viable option when the hot-mix asphalt maintains uniform thickness and there is no sign of stripping and raveling.

The D. Grant Mickle Award for the outstanding paper in the field of operation, safety, and maintenance of transportation facilities was presented to Bhagwant Persaud, Ryerson University; Hugh McGee, Bellomo McGee, Inc.; Craig Lyon, Ryerson University; and Dominique Lord, Texas A&M University, for their paper, Development of a Procedure for Estimating Expected Safety Effects of a Contemplated Traffic Signal Installation. Published in *Transportation Research Record No. 1840*, the paper describes a process for improving safety warrants for the installation of traffic signals and examines the impact of safety issues on the decision-making process.

HONORING A FRIEND—Lester Hoel, University of Virginia, with wife, Unni, and daughter, Sonja, at the Executive Committee reception honoring him as outgoing TRB Division Chair for National Research Council (NRC) Oversight. In his many contributions to TRB spanning more than 35 years, Hoel has served as Technical Activities Council Chair, Executive Committee Chair, and as a member or chair of more than 30 committees and panels. He spent an unprecedented nine years as chair of the TRB Executive Committee's Subcommittee for NRC Oversight. In that position, Hoel handled a large volume of committee and panel approvals and reports requiring review, with characteristic depth, detailed understanding, and good humor.

Jones Delivers Resounding Support for Context-Sensitive

The 13th recipient of the Thomas B. Deen Distinguished Lectureship, Richard Jones, retired Federal Highway Administration (FHWA) Regional Counsel, addressed the issue of tort liability concerns in context-sensitive design, January 12, 2004. Jones s lecture supported the context-sensitive design philosophy, which has been described as among the most significant concepts to emerge in highway project planning, design, and construction in recent years.

Context-Sensitive Design: Will the Vision Overcome Liability Concerns? examined the continuing concern that flexing design standards and guidelines would increase exposure to tort liability, because safety would be compromised. Jones, who retired in 1994 as FHWA s Counsel for Region 8 (Denver, Colorado), concluded that the vision of design excellence invoked by context-sensitive design principles will overcome the threat of liability.

What is envisioned is a process that results in a transportation project reflecting community consensus on purpose and need, with project features addressing equally: safety, mobility, and preservation of scenic, aesthetic, historic, and environmental resources. It involves policy judgments in the balancing of competing interests, Jones observed. Supporting his claim, he noted that Congress has established public policy clearly demonstrating that safety, a primary consideration in design, should be balanced with mobility, protection, and enhancement of the natural environment and preservation of community values.

I suggest that such public policy, because it reflects the public interest, will influence changes in tort law to better accommodate [context-sensitive design] processes, reducing liability exposure in both the short term and the long term, Jones explained. Solid documentary evidence, showing that context-sensitive design decisions involve a conscious balancing of public policy factors, is necessary to win favorable appellate decisions in the long term and individual cases in the short term, Jones maintained. The evidence will establish design immunity or explain and prove the reasonableness of design decisions based on the context within which they were made.

The lecture will be published in a volume of the 2004 series of the *Transportation Research Record: Journal of the Transportation Research Board*.

During his nearly 30 years with FHWA, Jones was involved in high-visibility legal activities, including litigating tort liability issues. As Regional Counsel, he served as the principal legal adviser for the six-state Federal Aid Highway program region, the six-state Office of Motor Carriers region, and the Central Federal Lands Division, representing the agency s Chief Counsel in all legal matters including litigation arising from program, prosecutorial, and procurement activities. One of Jones primary roles was to assure compliance with environmental requirements under the National Environmental Policy Act and other federal statutes and regulations protecting the natural and human environment. He was responsible for the legal sufficiency review of environmental impact statements for highway projects.

Jones: "Reflecting Community Consensus."

Since retiring from FHWA, Jones has served as a legal and transportation consultant, specializing in compliance with environmental requirements and in issues arising from highway transportation projects, including those on American Indian lands. He has served as special counsel for several megaprojects in Colorado; has advised on legal aspects of a World Bank—FHWA study on India s National Highway System; and has authored five articles for the National Cooperative Highway Research Program s Continuing Legal Research project.

The Thomas B. Deen Distinguished Lectureship is an annual award that recognizes the career contributions and achievements of an individual in one of the areas covered by TRB s Technical Activities Division. Honorees are provided the opportunity to present an overview of their technical area, including its evolution, present status, and prospects for the future.

Townes Guides 2004 Executive Committee

Michael Townes, President and Chief Officer of Hampton Roads Transit, Virginia, received the gavel as the 2004 Chair of the TRB Executive Committee from his predecessor Genevieve Giuliano during the Chairman s Luncheon.

A 20-year veteran leader in public transportation, Townes has been active in TRB for many years. He chaired the Transit Cooperative Research Program (TCRP) Oversight and Project Selection Committee and has served on several TCRP project panels. He also chaired the TRB Committee for the National Transit Database Study and has contributed his expertise to several other policy study committees. A member of the TRB Executive Committee since 2000, Townes serves on its Subcommittee for National Research Council Oversight and the Subcommittee on Planning and Policy Review.

Townes currently is a member of the Board of Directors of the Virginia High-Speed Rail Development Committee and is Chairman of the Norman Mineta Transportation Institute Board of Trustees and of the American Public Transportation Association s (APTA) Legislative Committee. In 1999, Townes was selected as the first president and chief executive officer of Hampton Roads Transit, a consolidated commission formed after the merger between the Peninsula Transportation District Commission (PENTRAN) and the Tidewater Transportation District Commission. While Townes was executive director of PENTRAN, the commission was honored with Virginia s Outstanding Public Transportation System Achievement Award and the APTA Public Transportation System Outstanding Achievement Award.

TRB s Vice Chair for 2004 is Joseph Boardman, Commissioner of New York State DOT.

2004 Executive Committee Chair Michael Townes hugs his predecessor Genevieve Giuliano following the gavel presentation at the close of the Chairman's Luncheon.

TRB Senior Program Officer Anne Brach discusses the Future Strategic Highway Research Program; an interim plan was outlined in NCHRP Report 510.

Cooperative Research Programs Director Robert Reilly (*left*), with Catherine Ross, Georgia Institute of Technology, responds to a question about program expansion.

2000 Executive Committee Chair Martin Wachs, University of California–Berkeley, offers insights during the TRB Executive Committee Winter Business Meeting.

The TRB Executive Committee Subcommittee for National Research Council Oversight works to ensure that TRB committee appointments and reports conform to high standards of the National Academies (left to right): Executive Director Robert Skinner, Jr.; C. Michael Walton, University of Texas–Austin (Subcommittee Chair); 2004 Executive Committee Vice Chair Joseph Boardman, New York State DOT; 2003 Chair Genevieve Giuliano, University of Southern California; 2004 Chair Michael Townes, Hampton Roads Transit; Associate Executive Director Suzanne Schneider; and John Craig, Nebraska Department of Roads.

EXECUTIVE COMMITTEE SESSIONS

The Executive Committee policy session focused on the interrelationship between global climate change and transportation. Expert panelists included (left to right) Michael MacCracken, Climate Institute, who assessed research on "The State of Climate Change Science"; Virginia Burkett, U.S. Geological Survey National Wetlands Research Center, who discussed the "Potential Impacts of Climate Change and Variability on Transportation in the Gulf Coast/Mississippi Delta Region"; George Eads, Charles River Associates, Inc., who detailed "The Transportation Community's Options for Reducing Greenhouse Gas Emissions: Economic and Political Constraints"; and Lee Schipper, the World Resources Institute Center for Transport and the Environment, who presented his research, "Looking at the CO_2/Transport Problem Through the Right End of the Telescope: A Challenge to the Nontransportation Community."

AASHTO President John Njord, Utah DOT, is one of the seven new members of the Executive Committee, along with Douglas Duncan, FedEx Freight; James Hertwig, Landstar Logistics, Inc.; Sue McNeil, University of Illinois–Chicago; Philip Shucet, Virginia DOT; C. Michael Walton, University of Texas–Austin; and Linda Watson, Corpus Christi Regional Transportation Authority.

Leaders at Work

Anne Canby, Chair of the Technical Activities Council, holds an informal meeting in the lobby of the Shoreham.

TRB Executive Director Robert Skinner, Jr., converses with Anthony Kane, Director of Engineering and Technical Services for AASHTO Committees.

EMERITUS MEMBERSHIP

TRB's emeritus membership category recognizes the significant, long-term contributions of individuals who have provided exemplary leadership and service on the Board's standing committees. The 2004 group of honorees, recognized at the Annual Meeting, are listed below.

Richard Miller, Chair of the Committee on Properties of Concrete (right), honors the long-term contributions of Edward Nawy.

Technical Activities Council

Kumares C. Sinha
International Activities

Policy and Organization

Elizabeth A. Deakin
Transportation and Land Development

Harvey Knauer
Transportation-Related Noise and Vibration

Frank S. Koppelman
Passenger Travel Demand Forecasting

Abba G. Lichtenstein
Historic and Archeological Preservation in Transportation

Alan E. Pisarski
Urban Transportation Data and Information Systems

Gordon A. Shunk
Transportation Planning Applications

Douglas L. Smith
Environmental Analysis in Transportation

Darwin G. Stuart
Transportation Programming, Planning, and Systems Evaluation

S. Ling Suen
Accessible Transportation and Mobility

Thomas L. Weck
Environmental Analysis in Transportation

Planning and Environment

David J. Forkenbrock
Transportation and Economic Development

Design and Construction

Craig A. Ballinger
Structural Fiber-Reinforced Plastics
Billy G. Connor
Frost Action

Braja M. Das
Chemical and Mechanical Stabilization

Barry J. Dempsey
Subsurface Drainage

Deborah J. Goodings
Modeling Techniques in Geomechanics

William H. Hansmire
Tunnels and Underground Structures

Lynne H. Irwin
Low-Volume Roads

Dennis M. Labelle
Utilities

R. Gordon McKeen
Engineering Behavior of Unsaturated Soils

Edward G. Nawy
Properties of Concrete

Engineering Geology Chair Thomas Badger, Washington State DOT (left), with emeritus member A. Keith Turner, Colorado School of Mines.

A. Keith Turner
Engineering Geology
Thomas J. Yager
Surface Properties, Vehicle Interaction

Thomas F. Zimmie
Physicochemical Phenomena in Soils

Operations and Maintenance

Daniel Brand
Intelligent Transportation Systems

John W. Bugler
Sealants and Fillers for Joints and Cracks

Ken F. Kobetsky
Traffic Control Devices
Roger E. Smith
Pavement Management

Yash Paul Virmani
Corrosion

Legal Resources

Richard W. Bower
Transportation Law

System Users

John W. Palmer
Operator Education and Regulation

Public Transportation

Jack W. Boorse
Light Rail Transit

Donald O. Eisele
Light Rail Transit

Thomas F. Larwin
Light Rail Transit

Roy E. Lave
Paratransit

Walter E. Zullig, Jr.
Commuter Rail Transportation

Aviation

John W. Fischer
Aviation Economics and Forecasting

Norman D. Witteveen

Airport Research Needs

Cooperative Solutions

TOM MENZIES

Approximately 5,000 airports are open to public use in the United States. Most are owned and operated by local and regional authorities, and some by states. Together these airports form a national system of infrastructure for long-distance passenger transportation, air cargo, and general aviation.

Airports connect the nation s aviation system with other modes of transportation. At airports, the federal government s management and regulation of air traffic intersects with municipal, county, and state governments ownership and operation of the facilities.

Airports are national and local resources, expected to meet national goals for aviation system efficiency and safety, as well as regional and local demands for noise reduction, environmental protection, and economic development. Airports are at the forefront of efforts to ensure aviation security a federal government imperative that requires the efforts of thousands of public and private airport operators, regulators, suppliers, and users in government and industry.

At the nexus of so many public demands and public-sector responsibilities, U.S. airports share many challenges and face many common problems that no single airport has the incentive or the resources to solve. Specific research needs and priorities may vary from one airport to the next, yet the general topics of interest are similar across the system. For example, most airports need to improve runway pavements smaller airports need pavements that are economical to build and maintain, and larger airports need pavements that are more durable and capable of handling heavier loads.

Environmental impacts such as aircraft noise, air pollution, and chemical runoff from deicing are major concerns at larger airports, yet all airports are subject to federal, state, and local environmental regulations, and all face challenges in compliance. In addition, operators of airports of all sizes and types are seeking cost-effective ways to strengthen the security of airfields, terminals, and other facilities.

Practical Solutions

Research is essential to meet these needs and to find practical solutions to shared problems. In some cases, it may be sufficient to conduct a systematic survey and evaluation of procedures and products that are already

A national Airport Cooperative Research Program (ACRP) modeled in part on the cooperative research programs for highways and public transit would confer lasting benefits in airport security, efficiency, safety, and environmental compatibility. ACRP would allow airport operators to work together and with federal agencies to identify problems, search for practical solutions, and disseminate the results.

succeeding at some airports, and then to ensure that all airport operators have good information on effective practices. In other cases, research may be required to develop new materials, equipment, designs, and techniques to address particular problems.

Through several agencies, the federal government provides the nation s airports with billions of dollars in aid each year; operates and regulates the nation s air traffic control system; provides and establishes standards for security; and sets environmental, safety, and design standards affecting airport configurations, equipment, and operations. The federal government, therefore, has a key role and much at stake in meeting critical airport research needs.

Federal Initiatives

The federal government sponsors airport-related research through the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), the Transportation Security Administration (part of the Department of Homeland Security), and other agencies.

At its Airport Technology Research and Development branch in the William J. Hughes Technical Center, Atlantic City, New Jersey, and through grants to universities, FAA sponsors research to investigate alternative runway and taxiway materials and configurations, lighting at approaches and other visual guidance technologies, runway snow- and ice-control materials and methods, fire and rescue operations, and mitigations for bird and other wildlife hazards. This research supports FAAs overarching mission to promote the safe and efficient operation of the national airspace system. Airport-related areas that are major recipients of federal aid and investments, such as runways and taxiways, receive a commensurate amount of attention in FAA research.

The FAA headquarters and division offices also conduct airport-related research through special studies for example, to improve models for aircraft air pollutant emissions and methods for measuring airport noise. Most of this research, however, is short term, driven by specific rulemaking initiatives and policy proposals.

In contrast, NASA undertakes aeronautics research that can span decades. For example, NASA sponsors research to reduce aircraft noise through innovative propulsion systems, not through incremental improvements in conventional techniques for engine noise abatement.

DoD sponsors research on topics relevant to military needs, with occasional applications to civil aviation. In addition, research undertaken by FAA, NASA, and DoD on air traffic control systems can have significant implications for airport operations, configurations, capacity, and environmental compliance.

Completing the Portfolio

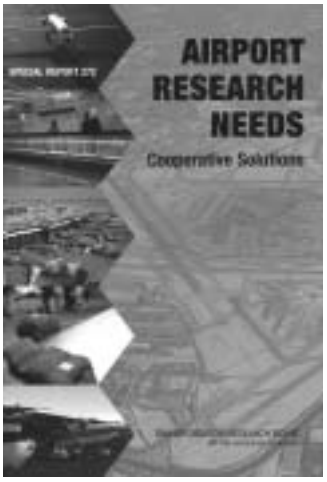
Missing from this varied research and development portfolio, however, is a program of applied research that views the nation s airport landside, airside, and air traffic management systems as functioning in concert to form the national airspace system. Airport operators can identify factors that affect the overall safety, capacity, and efficiency of facilities for instance, how air traffic control rules affect airport operations and capacity, how airport facility constraints affect congestion and delay, and how regulations governing noise and other environmental factors affect the ability of airports to meet demands for aviation services.

Nevertheless, airport operators do not have a direct role in advising federal agencies on research and development and do not have a way to pool ideas and resources to develop or disseminate solutions to shared problems. Airport-sponsored research usually proceeds at the behest of individual operators, and dissemination of results to other operators is often haphazard, even when the application may be widespread.

Successful Models

In contrast, the operators of two other transportation modes state highway departments and public transit agencies have the means to work together to identify needs and find solutions to common problems. The National Cooperative Highway Research Program, established in 1962, pools federal-aid research funds volunteered by individual states to develop near-term, practical solutions to problems facing many highway agencies. Likewise, for more than a decade, the Transit Cooperative Research Program has sponsored research and other technical activities that respond to the needs of the public transit industry.

Managed by the Transportation Research Board (TRB) of the National Academies, both programs involve operators in the central role of identifying prob-



Special Report 272: Airport Research Needs: Cooperative Solutions is available from TRB (see Publications Order Form in this issue).

Committee for a Study of an Airport Cooperative Research Program

James C. DeLong, Louisville International Airport (retired), Kentucky, *Chair*
Marlin Beckwith, California Department of Transportation (retired), Sacramento
James M. Crites, Dallas–Fort Worth International Airport, Texas
Barry J. Dempsey, University of Illinois, Rantoul
Edward L. Gervais, Boeing Commercial Airplanes, Seattle, Washington
Angela Gittens, Miami–Dade International Airport, Florida
Adib Kanafani, University of California, Berkeley
Carolyn S. Motz, Hagerstown Regional Airport, Maryland
George P. Vittas, DMJM Aviation, Fort Worth, Texas

lems and of programming specific research projects to address the problems. This applied research does not replicate the work of the federal government or industry but focuses on operators often urgent needs and problems, which otherwise may be overlooked or may not appear on the research agenda of federal agencies or industry organizations for several years.

Creating a Program

In the past decade, many individuals and organizations have urged the creation of an airport cooperative research program modeled in part on the programs for highways and public transit. The National Association of State Aviation Officials and the Airports Council International—North America developed and championed such proposals. In legislation reauthorizing FAA in 2000 (Public Law 106-181), Congress requested a formal study of the concept by the U.S. Department of Transportation, which in turn contracted with TRB through the National Research Council (NRC) of the National Academies.

NRC assembled a committee under the auspices of TRB with a range of expertise and a balance of perspectives on related issues. James C. DeLong, recently retired as manager of Louisville International Airport, chaired the committee, which included nine other experts in airport management, design, engineering, environmental analysis, and research and planning (see box, this page).

After studying the organization, process, and products of the cooperative research programs for other modes, as well as the research needs of airports, the committee concluded that a national Airport Cooperative Research Program (ACRP) would confer lasting benefits in airport security, efficiency, safety, and environmental compatibility. In its final report, published as TRB Special Report 272, *Airport Research Needs: Cooperative Solutions,* the committee urged Congress to establish a program in which airport operators, working with one another and with the various federal agencies, would be involved actively in the identification of problems, the search for practical solutions, and the dissemination of the results.

The committee recommended creation of a program that would be

- Governed primarily by airport operators, who also would guide the research agenda, with active participation and close collaboration from federal agencies, airport users, and others expected to use and implement the results;
- Financed with revenues derived from aviation users a funding arrangement that would prompt a strong sense of ownership of the program by the airport and aviation communities and a commitment to meeting their needs; and
- Managed to ensure that the research products meet scientific and professional standards of quality and are accessible to users, recognizing that at all stages the program s research projects must be guided by a combination of technical experts and practitioners to ensure objectivity, credibility, applicability, and dissemination.

Congressional Approval

In the Vision 100: Century of Aviation Reauthorization Act of 2003, Congress authorized $10 million per year for ACRP in Fiscal Years 2004 through 2007. Approval of the act, however, came too late for the appropriation of funds for Fiscal Year 2004. The annual federal appropriation process will determine ACRP funding in Fiscal Year 2005 and beyond. In the interim, FAA is working with the airport operator and user communities and TRB to elicit research needs and to establish the structure for program governance and management (see box, next page).

The author, a Senior Program Officer in the TRB Division of Studies and Information Services, served as study director for this project.

Airport Cooperative Research Program

Preparing for Takeoff

The Airport Cooperative Research Program (ACRP) was authorized in December 2003 as part of the Vision 100: Century of Aviation Reauthorization Act. ACRP will be sponsored by the Federal Aviation Administration (FAA) and managed by the National Academies through the Transportation Research Board (TRB), with program oversight and governance by representatives of airport operating agencies.

ACRP will carry out applied research on problems shared by airport operating agencies but not adequately addressed by federal research programs. Research and technical activities will cover design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration.

Program Participants. The primary participants in ACRP will be

- An independent governing board with representation from airport operating agencies, other stakeholders, and industry organizations such as the Airports Council International–North America, the American Association of Airport Executives, the National Association of State Aviation Officials, and the Air Transport Association;
- TRB as program manager and secretariat for the governing board; and
- FAA as program sponsor.

ACRP will enlist the cooperation and participation of airport professionals, state and local government officials, equipment and service suppliers, airport users, and research organizations.

Selection of Research. ACRP will solicit research problem statements periodically and will accept submissions by anyone at any time. The ACRP governing board will formulate the research program, identifying the highest priority projects and defining funding levels and expected products.

Program Management. ACRP will be managed according to procedures adapted from the National Cooperative Highway Research Program and the Transit Cooperative Research Program. Day-to-day program management will include the following tasks:

- Assisting the governing board in identifying and prioritizing research needs;
- Appointing and coordinating expert technical panels to guide research projects;
- Developing and distributing requests for proposals;
- Processing and evaluating proposals to select the best qualified research agencies;
- Executing contracts with the selected researchers;
- Guiding the research;
- Reviewing research reports;
- Publishing and disseminating research reports; and
- Promoting the application of research results.

Project Panels. Each project will be assigned to a TRB-appointed panel, which will provide technical guidance and counsel. Panels include experienced practitioners, research specialists, and the intended users of the products. The panels prepare project statements, evaluate proposals, select contractors, guide the research, and review the reports. Panel members serve voluntarily without compensation.

Contractor Selection. The selection of ACRP researchers will follow an open process that allows all research agencies to compete on technical merit and that ensures fair treatment, as well as access to the best talent available for each project.

Funding. FAA will make sufficient funding available in 2004 to enable the ACRP to be organized and prepared to carry out research as funds are appropriated (see feature article for more details).

Products. The emphasis is on disseminating research results to the intended end-users—airport operating agencies, service providers, and suppliers. Industry associations will play key roles in making research information available. ACRP will produce research reports; industry associations may arrange for workshops, training aids, field visits, and other activities to encourage implementation.

Status. ACRP is in the formative stage. A Memorandum of Agreement between FAA, TRB, and airport industry representatives is in development. The ACRP governing board will be established according to the terms of the Memorandum of Agreement and is expected to meet in spring 2004 to establish operating procedures and to prioritize research needs.

To submit a research problem statement or to request further information on ACRP, contact Robert J. Reilly, Director, Cooperative Research Programs, TRB, 500 Fifth Street, NW, Washington, DC 20001; telephone 202-334-3224; fax 202-334-2006; e-mail breilly@nas.edu. Program information is available at www.TRB.org/acrp.

Are Traffic Signals Warranted in All School Zones?

Indiana Study Verifies Industry Standards

TOMMY E. NANTUNG

Transportation agencies and the public are interested in improving safety in school zones but sometimes do not agree on the best approach.

Problem

Crashes at intersections adjacent to schools attract press coverage and provoke community discussion. After a significant crash, parents, local groups, and city officials often request the installation of a traffic signal to improve safety at the intersection. The vigor of the request increases if the crash involves personal injuries, particularly to children.

After receiving a request to install a traffic signal, Indiana Department of Transportation (DOT) performs an engineering study following guidelines in the *Manual on Uniform Traffic Control Devices* (MUTCD). Often the study indicates that installation of a traffic signal is not warranted, and the request is denied.

The denials then generate additional press coverage and requests for explanations. The requests are difficult to address because of limited data that quantitatively document the effect of signals on crash rates.

Solution

Indiana DOT contracted with Purdue University through the state—university Joint Transportation Research Program to analyze crash data before and after the installation of traffic signals that were marginally warranted that is, at intersections that barely met the MUTCD warrants or qualifying criteria for traffic signals. Working with Indiana DOT, a research team led by Darcy M. Bullock, a professor at the Purdue University School of Engineering, identified 19 traffic signals installed between 1994 and 1996; 7 of the signals were near schools.

Crash data from 1991 to 1999 were collected and categorized by type, severity, and proximity to the intersection. The data were adjusted to account for changes in average daily traffic and the number of years of available before-and-after data. Table 1 summarizes the statistical comparison of the before-and-after crash rates.

Pedestrian crashes are rare and therefore difficult to analyze statistically. Because no pedestrian crashes

TABLE 1 Statistically Significant Changes in Crash Rates

Data set	Crash categories with observed reductions	Crash categories with observed increases
7 signals adjacent to schools	None	Total Number Property Damage Only Rear End Head On Run off Road Left Turn
19 signals (including those at schools)	Right Angle Right Turn	Total Number Personal Injury Rear End Head On Run off Road Left Turn Other

were recorded at the 19 intersections before or after traffic signals were installed, the study did not include that category.

The results reconfirmed the appropriateness of the MUTCD warrants. The researchers therefore recommended that Indiana DOT should not install traffic signals if the MUTCD warrants were not met or were marginal.

The report presents alternatives to traffic signals that other agencies have found useful in improving safety near schools:

- Place adult crossing guards at wide streets the guards should wear brighter vests and uniforms and should undergo special training;
- Enforce speed limits more strictly near schools extend zero tolerance for speeding in 15-mph zones, set speed limits of 5 mph for other zones, and raise fines or add points for school zone citations;

- Paint SCHOOL on the pavement of high-speed approaches;
- Establish buffers and wider sidewalks with larger waiting areas for students and Stand Back lines to restrain students;
- Increase safety training for students; and
- Develop safest route to school plans that prevent the location of new elementary schools on major streets, and that use arterial streets as boundaries for school populations.

Benefits

Indiana DOT now can cite the research results to demonstrate that a traffic signal is not always the best way to improve safety. Other treatments can be effective at lower costs.

For example, as a result of this study, Indiana DOT has justification for not installing 40 requested traffic signals. Since an average signal costs $68,000, the total savings amounts to $2,720,000, not including the savings in power, maintenance, and operations costs.

For further information contact Tommy Nantung, Research Division, Indiana Department of Transportation, 1205 Montgomery Street, P.O. Box 2279, West Lafayette, IN 47906 (telephone 765-463-1521, Ext. 248, e-mail tnantung@indot.state.in.us).

EDITOR'S NOTE: Appreciation is expressed to B. Ray Derr, Transportation Research Board, for his 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).

Willem Ebersöhn

Amtrak Engineering

Willem Ebers hn s professional achievements in railroad engineering span two continents, as well as careers as a researcher, educator, and practitioner with expertise in track maintenance management and railroad geotechnology. Colleagues praise the South African professor turned Amtrak engineer for his contribution to the development and implementation of new techniques in railway infrastructure management on heavy-haul and high-speed railway operations.

In late 2000, Ebers hn joined the high-speed rail project at Amtrak as director of engineering systems. He moved to the United States after 13 years as a professor at the University of Pretoria, South Africa, where he established a program in railway engineering education and performed research and development in the field of railroad maintenance management. Ebers hn says he was enticed by the maintenance engineering challenges facing Amtrak in operating high-speed intercity service on an old, congested right-of-way that also runs heavy-haul axle loads.

"To be a good railway engineer you have to understand engineering and business concepts of related railway

Since joining Amtrak, Ebers hn has developed and implemented an infrastructure management system. He conducted a helicopter survey of Amtrak s Northeast Corridor from Boston to Washington, D.C., to obtain an accurate asset inventory and to detect imminent failures in the electrical overhead system. In addition, he was instrumental in the development and installation of a high-speed wayside vehicle track interaction measuring system.

Ebers hn has authored 11 papers in peer-reviewed journals and presented research at 14 peer-reviewed conferences, mostly on railway maintenance management and geotechnology. He was selected by the International Heavy Haul Association as one of four international specialists to coauthor *Guidelines to Best Practice for Heavy Haul Railway Operations: Wheel and Rail Interface Issues*, published in 2001.

Ebers hn traces his interest in railroading to the late 1970s when he was an undergraduate at the University of Pretoria. The South African Railway and Harbours, now known as Spoornet, awarded him a full scholarship. He went on to earn a master s degree in structural properties of railroad components in 1985 and then began work for the railroads in South Africa.

Early in my career I learned that to be a good railway engineer you have to be able to think outside the comfort of your own railway engineering field and understand the engineering and business concepts of all the related railway departments, he notes. Although he worked on tracks as a civil engineer, Ebers hn took the initiative to learn about mechanical engineering of the fleet, electrical engineering of signals and electric traction, and transportation engineering of train control.

Faced with practical challenges and major failures of some of the South African heavy-haul coal export lines, Ebers hn recognized that a pure structural approach to track component development was ineffective without a sound understanding of the railroad foundation and all the aspects of railroad geotechnology.

With the guidance of Ernest Selig at the University of Massachusetts, Ebers hn earned a Ph.D. in railroad geotechnology in 1994. His research developed the railroad substructure condition assessment techniques used at several sites in the United States and South Africa.

The information gathered with Ebers hn s techniques and the integrated presentation of the data led to the development of the railway infrastructure management system implemented by Amtrak and Spoornet. The Federal Railroad Administration has adopted the system database design, and two U.S. railroads and one commuter agency are implementing infrastructure management systems with the system design.

The research and development for the management system was performed by students in the Continued Education Program in Railway Engineering at the University of Pretoria. Approximately 80 to 120 students, including internationally recognized experts, participate each year in this graduate level collaborative research program founded by Ebers hn in 1990. Ebers hn was a senior lecturer at the university from 1987 until 1996, when he was named chair of Railway Engineering.

Selig introduced Ebers hn to TRB in 1991, and he has participated in nearly every annual meeting since. Ebers hn has contributed several papers to the *Transportation Research Record*, and he is now a member of the Rail Group Executive Committee and chair of the Committee on Railway Maintenance.

Ebers hn sees the development of an integrated railroad enterprise asset management as imperative, because of the high demand, complexity, and inaccessibility of the railroad infrastructure and because of the dangerous operating environment.

The industry has not yet fully embraced the use of modern-day mobile computing, communication, and tracking technology for information management, he says. Integrating these technologies into the railroad asset management environment will allow managers to know what is happening in the field, improving their efficiency in managing scarce resources.

William R. Lucas

Surface Deployment and Distribution Command

Every year, the U.S. Military Surface Deployment and Distribution Command (SDDC) coordinates the movement of 3.7 million tons of cargo, 600,000 domestic freight shipments, 100,000 containers of sustainment, 500,000 household goods shipments, and 75,000 privately owned vehicles for U.S. military personnel around the world. With the onset of Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom, the task of mobilizing troops and equipment has reached a magnitude not seen since World War II.

When you move parts of eight and a half Army divisions, two Marine Expeditionary Forces, and their equipment in a cascade of deployment and simultaneous redeployment halfway around the world, it becomes an incredible synchronized ballet and an absolute team sport, remarks William R. Lucas, Deputy to the Commander of SDDC.

"The capability of SDDC is the result of an incredibly strong relationship with and dependence on all modes of the U.S. commercial

Lucas, the senior civilian in the Command, acts as liaison to the hundreds of commercial transportation industry partners who move and sustain the military forces during peace and war. The mission has an annual budget of $3 billion and operates from 24 seaports around the world. Lucas, who has served as deputy since 1990, does not take the scope of his responsibilities lightly.

It affects every warfighter in terms of deployment and sustainment, every depot and military installation in terms of traffic management, and every soldier, sailor, airman, and marine and their families in terms of quality of life as they move to new stations or arrange official travel, he observes.

Lucas has provided critical guidance and oversight for deployment, sustainment, and redeployment for every military and humanitarian assistance action from Desert Storm to the Global War on Terror. He has been instrumental in lowering costs, awarding new contracts, and improving the efficiency of shipments for SDDC, formerly the Military Traffic Management Command.

Lucas directed SDDC analysis for congressionally mandated mobility studies that gained additional heavy-lift rail cars and other enhancements. The organizational streamlining and outsourcing that he emphasized reduced the Command structure by 46 percent, with employee assistance efforts finding new assignments for all but two personnel. Lucas orchestrated a reengineered business process for the annual, worldwide movement of 75,000 privately owned vehicles, achieving a 99 percent customer satisfaction rating and a 20 percent reduction in the cost to move these vehicles. He also outsourced container leasing and management, replacing 13 contracts that had minimal performance standards and several government personnel with a single contractor that adheres to strict standards.

Lucas has used industry—government integrated process teams extensively to develop performance-based, best-value contracts. In particular, the worldwide ocean shipping contract, valued at $400 million annually, was so successful a model for best industry practice and partnership that SDDC received the prestigious Admiral of the Ocean Sea award only awarded to government entities three times in the last 34 years.

Lucas is a charter member of the Strategic Distribution management initiative that brought together the U.S. Transportation Command, Defense Logistics Agency, Army and Air Force Exchange Service, Defense Commissary Agency, and the Armed Services to improve distribution and customer wait time. Lucas helped reduce aggregate customer wait time worldwide on surface shipments by 12 days.

The capability of SDDC is the result of an incredibly strong relationship with and dependence on all modes of the U.S. commercial transportation industry, he notes. That dependence and the ever-increasing need for speed and ability keep us tuned in to research in transportation, including advances in transportation platforms, management information systems, radio frequency identification tags, and satellite tracking devices.

SDDC is focused on improvements that contribute to the security of highly sensitive cargoes. Lucas participated in the development and conduct of a TRB national conference, Global Intermodal Freight: State of Readiness for the 21st Century, and he has served on several TRB Annual Meeting panels.

Lucas graduated from the University of Maryland with a bachelor s degree in management studies and attended the Federal Executive Institute in 1985 and the Industrial College of the Armed Forces, 1989—1990. Before his appointment as deputy, he held various assignments within SDDC for the Freight Traffic Division, Defense Freight Railway Interchange Fleet, and Freight Automation Office. He has received two Meritorious Presidential Awards in 1997 and 2002 and two Meritorious Civilian Service Awards in 1994 and 1996.

Lucas says he is proud to work at SDDC: I frequently tell our folks, listen to the headlines on the way to work, and you can guess where the job will take you that day. Whether it is supporting humanitarian efforts, disaster relief, relocating our military and their families, or responding to crisis and war, it will definitely be a day you can make a positive difference in someone s life.

Value Engineering Design Cuts Cost of Bridge Project

The West Virginia Department of Transportation (DOT) significantly reduced material and fabrication costs in the construction of a new pair of bridges spanning the Little Kanawha River in Wood County, through a value engineering redesign of the project. The optimized design saved 1.5 million pounds of steel 15 percent of the original amount due to a variety of girder designs, reduced use of longitudinal stiffeners, skewed and refined crossframe lines, and elimination of spiral girder geometry.

In September 2001, the DOT s Division of Highways advertised for the construction of the twin 1,275-foot bridges, part of a new corridor routing US-50 around Parkersburg. After preliminary review of the original design showed a potential for savings, HDR Engineering, Inc., partnered with steel fabricator High Steel Structures, Inc., to offer an alternative design to construction bidders. Bilco Construction Company submitted the winning bid and agreed to consider the value engineering redesign, subsequently accepted by the DOT s Division of Highways.

The original design of the bridges called for a significantly larger amount of steel than similar bridges. The twin bridges were composed of five span continuous variable-depth steel plate girders. The bridges were slightly curved and spiraled for portions of the first two spans and flared at the opposite ends to accommodate ramp bifurcations. The girders had a web depth of 9 feet for the majority of the bridge lengths and transitioned to 12 feet for the main 350-foot river span. The team of designers, fabricators, and erectors worked to save on costs but retain the basic girder layout and leave the as-designed deck and substructure unchanged.

In the value engineering redesign, the team prepared separate girder designs for the interior and

PHOTO: HDR

The US-50 bridges in West Virginia were subjected to a value engineering redesign, which saved 1.5 million pounds of steel.

FOOTBRIDGE FOR ALL TIME—Scheduled for completion this summer, the Sundial Bridge crosses the Sacramento River in the heart of Redding, California, amid the Trinity and Cascade Mountains, pine forests, and cascade lakes. Spanish architect Santiago Calatrava designed the $23.5 million footbridge, which links the north and south campuses of the new Turtle Bay Exploration Park and serves as a downtown entrance to the river trails. It was almost entirely financed by the private McConnell Foundation.

The bridge's tapered mast tilts 40 degrees due north, functioning as a sundial that casts a shadow on markers in a garden below. More than an aesthetic design, the bridge suspends over the river to avoid a nearby endangered salmon-spawning habitat that forbids any permanent or temporary structure in the river. A total of 18, 40-foot sections of the bridge were prefabricated at a steel yard in Vancouver, Washington, and transported by truck to Redding. The parts, supported by cables stretched from the pylon, were welded together above the water.

For further information visit www.turtlebay.org/bridge/index.html.

exterior girders, so that the curved and straight portions of the structure met AASHTO specifications. The team also evaluated the cost-effectiveness of using thicker webs or longitudinal stiffeners in the girder design. Longitudinal stiffeners were not economical at 9-foot girder depths but were economical in the 12-foot deep sections.

The team then decided to skew the crossframe lines, originally oriented normal to the girders, eliminating 21 lines and simplifying crossframe details to one-piece frames. The original design called for each girder to transition from curved to spiral to tangent sections, but steel fabrication equipment cannot permit a girder to be curved to spiral geometry. The team saved time and money by substituting the process with compound circular curves to approximate the geometry of the spirals.

Summarized from the January 2004 issue of Bridgeline, *a technical publication produced by HDR. For further information visit www.hdrinc.com.*

Report Promotes Pedestrian Safety

A new Federal Highway Administration (FHWA) study has outlined safety measures that could reduce the number of pedestrians hit by motor vehicles. The findings suggest that proper signals and signage, raised and curb medians, nighttime lighting, speed humps, converted one-way streets, improved sidewalk capacity, and stricter law enforcement could improve safety conditions and deter unyielding motorists and illegal pedestrian crossings.

Released in January 2004, *A Review of Pedestrian Safety Research in the United States and Abroad* provides an overview of recent foreign and domestic studies on pedestrian safety, including details of crash characteristics, crash countermeasures, and safety effects of specific roadway improvements. The report is confined to safety research and does not address facility design, finance, pedestrian comfort, convenience, and factors that affect walking.

In the report, the authors note that the most common pedestrian crash types include dart-outs, intersection dashes, and turning-vehicle collisions. Pedestrians are more likely to be hit at night or in an urban area and are most likely to die as result of higher-speed rural collisions, according to the study.

Although pedestrian—vehicle collision rates have dropped 25 percent in the last 10 years, walking remains a disproportionately risky mode of transportation, representing 11 percent of traffic fatalities yet only 6 percent of all trips. In 2001, there were 4,882 pedestrian fatalities and 78,000 pedestrian injuries resulting from traffic crashes, according to statistics on the website www.walkinginfo.org.

Emphasis on highway transportation historically has focused on increasing the safety and mobility of motor vehicles, according to the FHWA report. [But] it is clear that pedestrian safety has emerged in recent years as a topic of growing interest and concern.

Among the findings, the authors note that on a busy multilane road, collisions are more likely at a marked crosswalk than an unmarked one. The authors recommend that marked crosswalks contain traffic and pedestrian signals when warranted, raised medians, and other speed-reducing measures.

Useful signs include yield to pedestrians when turning, pedestrians watch for turning vehicles, and the three-section walk with care, don t start, and don t walk signal. The study notes that curb medians provide a safer environment for pedestrians than two-way, left-turn lanes or undivided highways.

The study found that half as many pedestrian collisions occur at intersections that stop traffic in all directions to permit pedestrian crossing than at those with standard timing signals. The authors suggest that an exclusive pedestrian interval scheme could be used in high-volume pedestrian areas with light traffic. Overpasses and underpasses can improve safety substantially for pedestrians crossing freeways or busy arterial streets, if facilities are carefully planned to encourage pedestrian use, the report notes.

The authors argue for improved management of sidewalk capacity in central business districts (CBC), where pedestrian traffic may spill onto roads. Refuse cans, parking meters, control boxes and poles, newsstands, bus benches, and street furniture, among other obstructions, can reduce the pedestrian capacity of CBC sidewalks. In addition, the authors note that converted one-way streets can simplify pedestrian crossing, particularly when vehicle speeds do not increase. Moreover, substantially improved nighttime lighting of roads can enhance pedestrian safety.

For more information and to read the full report, visit www.walkinginfo.org/rd/safety.htm#pedsynth.

PHOTO: DAN BURDEN

A curb median provides a safe environment for pedestrians waiting for incoming traffic to pass.

Sensor Measures Bridge Clearance

The U.S. National Oceanic and Atmospheric Administration (NOAA) is expanding the availability of a bridge clearance sensor that assists mariners in avoiding collisions with bridges. Air Gap provides a real-time measurement of the distance between a bridge and the water s surface. NOAA is adding the capability to its data suite of oceanographic and meteorological observations through the Physical Oceanographic Real-Time System (PORTS¤) program.

Air Gap sensors have operated at two bridges on the Chesapeake—Delaware Canal since March 1, and the observations are being publicly disseminated on the Chesapeake Bay PORTS, along with information on water level, currents, and winds. Funded by the Maryland Port Administration, PORTS publishes the Air Gap readings every six minutes because of changes in tidal water level, traffic patterns, and air temperature that cause fluctuations in bridge clearance.

The sensors were deployed on the center spans of bridges in Reedy Point, Delaware, and Chesapeake City, Maryland. Because they are noncontact devices that do not need to be physically in the water, Air Gaps have eliminated many of the problems associated with reliably operating sensors in the marine environment.

The Chesapeake PORTS air gap system is the first of its kind in the nation, but some of the other nine PORTS across the United States plan to add the capability. Air Gap has been extensively tested, evaluated, and adapted for use as a bridge clearance device by the NOAA Ocean Service s Center for Operational Oceanographic Products and Services (CO-OPS). A CO-OPS technical report documenting the testing and integration of the Air Gap sensors into the CO-OPS product suite will be available soon.

PHOTO: NOAA

Ships approaching bridge must be able to gauge changes in clearance.

For further information on Air Gap or CO-OPS, visit www.noaa.gov.

Budget Office Backs Gas Tax Hike

A five-cent hike on gas taxes would do more to deter driving and reduce pollution, at less cost to consumers, than a comparable boost in Corporate Average Fuel Economy (CAFE) standards would, according to a recent report released by the Congressional Budget Office (CBO).

PEOPLE IN TRANSPORTATION

Port Expert Assists in Iraq Reconstruction

Wakeman

Thomas Wakeman III, Cochair of TRB s Marine Environmental Task Force, has accepted an assignment in Iraq to advise on the rebuilding of the nation s ports and waterways. The appointment by the U.S. Department of Defense started March 1 and could last up to 18 months.

On leave from the Port Authority of New York and New Jersey (PANYNJ), Wakeman is working with Iraq s Ministry of Transportation to restore port and waterway infrastructure and freight handling terminals. His efforts initially will focus on the nation s major port of Umm Qasr and on four other maritime facilities, including Basrah. Major dredging work is needed to accommodate the larger ships that are used by today s ocean carriers, Wakeman said.

Before the appointment, Wakeman was overseeing PANYNJ s $2 billion port dredging program. He joined the Port Authority in 1994 after a 20-year career with the U.S. Army Corp of Engineers. He has been involved with TRB and Marine Board activities for five years.

Civil Engineers Honor Levinson with Lectureship

TRB Executive Committee member Herbert Levinson delivered the Francis C. Turner Distinguished Lecture at the American Society of Civil Engineers National Conference and Exposition, November 2003. The longtime transportation consultant was selected in recognition of his outstanding contributions over the years to both the theory and practice of transportation engineering. His lecture was titled, Highways, People, and Place Past, Present, and Future. Levinson was elected to the National Academy of Engineering in 1994 and became a national associate of the National Academies in 2002.

Levinson

Operations Center Named for Kassoff

The Maryland Department of Transportation s State Highway Administration

The December 2003 study, *The Economic Costs of Fuel Economy Standards Versus a Gasoline Tax,* uses a 10 percent reduction in gasoline consumption as a benchmark for comparing the costs of three policies: increasing the average federal, state, and local taxes on gasoline; or raising CAFE s miles per gallon standards with or without permitting manufacturers to trade fuel economy credits. Trading would allow producers to meet the new standards by buying credits from other producers that exceed the standards.

The report found that increasing taxes from 41 to 46 cents per gallon would achieve the targeted reduction at a cost of $2.9 billion per year compared with $3 billion by raising CAFE standards with trading and $3.6 billion for improved standards without trading. CAFE standards imposed on new cars would increase from 27.5 miles per gallon (mpg) to 31.3 mpg and standards for light trucks would rise from 20.7 mpg to 24.5 mpg.

The report s authors surmise that while the tax and CAFE policies would improve the fuel economy of new vehicles, the tax hike would produce greater immediate gasoline savings by inducing owners of both new and existing vehicles to drive less. In contrast, by making cars more fuel-efficient, higher CAFE standards would encourage owners of new vehicles to driver more but would not affect owners of existing vehicles, the authors conclude.

Consumers would bear the brunt of the costs under all of the policies considered, according to the CBO estimates. The report does not consider how changes in the CAFE standards or increases in the gas tax would affect labor or capital markets.

For further information, view the entire report at ftp://ftp.cbo.gov/49xx/doc4917/12-24-03_CAFE.pdf.

INTERNATIONAL NEWS

High-Speed Maglev Opens in Shanghai

On January 1, China began commercial operation of a $1.2 billion magnetic levitation (maglev) train that connects Pudong International Airport to Shanghai s downtown financial district. Traveling at a top speed of 268 mph, the maglev train traverses the 20-mile distance in 7.5 minutes, while an average taxi ride takes more than 1 hour.

Applying German technology, the maglev system underwent nearly a year of testing after an inaugural experimental run on December 31, 2002. The German consortium, Transrapid, spent decades and billions of dollars developing maglev technology before Shanghai officials selected the system to improve access to its 3-year-old airport and to highlight China s drive for excellence in technology. Germany shelved plans for a maglev train connecting Berlin and Hamburg in 2000.

Summarized from the March—April issue of Innovation Briefs, *published by Urban Mobility Corporation. For further information on the Shanghai Maglev Line visit http://home.t-online.de/home/jok.geo/maglev-china-shanghai-main.htm.*

A maglev train in Shanghai, China, takes travelers from the new airport to downtown, a 20-mile trip, in less than 10 minutes.

renamed its Statewide Operations Center after former administrator Hal Kassoff, who served between 1966 and 1984. Kassoff, now with Parsons Brinckeroff, helped secure 100 percent federal funding for the construction of the center, which opened in 1995. The center monitors a network of intelligent transportation systems technologies to expedite emergency operations and provide real-time traffic and weather conditions online.

Kassoff

Under Kassoff s leadership, the highway administration created the nation s first statewide incident management and traffic management program and won several awards for major highway projects. He has been active in several TRB transportation systems activities and is currently a member of the Task Force on Accelerating Innovation in the Highway Facility.

Academy Inducts Transportation Experts

The National Academy of Engineering (NAE) elected 76 members and 11 foreign associates in February, including two transportation experts active in TRB. The class of inductees brings the total U.S. membership to 2,174 and the number of foreign associates to 172.

Garber

Nicholas Garber, Professor and Chairman of the Civil Engineering Department at the University of Virginia—Charlottesville, was recognized for his significant contributions to national and international engineering education and research in traffic operations and safety. He has served on the TRB Committee on Work Zone Traffic Control for 20 years, on two National Cooperative Highway Research Program project panels, and with the Commercial Truck and Bus Safety Synthesis Program. Kaspar Willam, Professor of Civil Engineering at the University of Colorado—Boulder and a TRB individual affiliate, also was inducted into NAE for his contributions to constitutive modeling and computational failure analysis of concrete and quasi-brittle materials and structures.

Clearinghouse Highlights Environmental Research

The American Association of State Highway and Transportation Officials (AASHTO) has launched a website to provide a one-stop source of environmental information for transportation professionals. The site, www.environment.transportation.org, posts TRB Cooperative Research Programs environment-related projects, tracks federal agency developments, monitors key transportation stakeholder websites, and links to current regulations, laws, documents, and reports.

The website is the Internet arm of AASHTO s Center for Environmental Excellence, which promotes environmental stewardship and encourages innovative ways to streamline the transportation delivery process. TRB Planning and Environment Group Chair Neil Pedersen, Maryland DOT, was named to the 11-person Advisory Board of the center.

PROJECT CONSIDERATIONS—The TRB Executive Committee's Subcommittee on Planning and Policy Review held its semiannual meeting at the National Academies Keck Center in Washington, D.C., in March to review proposals for new TRB studies and conferences, and to discuss and approve other policy and program initiatives.

Top: Philip Shucet, Virginia DOT; and Ronald Kirby, Metropolitan Washington Council of Governments. *Bottom right:* Stephen Godwin, TRB Director of Studies and Information Services, and Michael Walton, University

From left: TRB Executive Director Robert Skinner, Jr., Nancy Ackerman, and Associate Executive Director Suzanne Schneider during a reception honoring Ackerman.

Longtime Publications Director Retires

Publications Director Nancy Ackerman retired this spring, after 24 years of service at TRB. During her tenure, the Publications Office released approximately 80 special report policy studies, 123 issues of *TR News*, and nearly 970 volumes of the *Transportation Research Record* journal series, among other publications. Ackerman led efforts to upgrade the quality of editorial content and design and navigated TRB into the era of electronic publishing via desktop, the web, and CD-ROM.

Ackerman oversaw the production of *Bridge Aesthetics Around the World* (1991), the first book to receive an award by the National Society of Professional Engineers. Other TRB milestone publications completed under her direction include several editions of the best-selling *Highway Capacity Manual*, the expanded *Landslides: Investigation and Mitigation* (1996), and the special full-color issue of *TR News* marking TRB s 75th anniversary (1996).

Ackerman was hired by the National Academies in 1979 as a manuscript editor at the National Academies Press before joining the staff of TRB in 1980 as editor of the Synthesis series. She was promoted to publications director in 1983. In 1986, the Publications Office was the first TRB unit to receive a Group Recognition Award from the National Research Council.

TRB Executive Director Robert Skinner, Jr., praised Ackerman s dedicated service to TRB and the creativity and high standards she brought to TRB publications.

INTERNATIONAL VISITORS—A delegation of transportation professors from Lanzhou Jiaotong University in northwest China visited with TRB leadership in December 2003 during a nationwide tour of academic, governmental, and private-sector institutions to gather information about management of transportation research and practice. The university, a base for scientific research and training in the areas of rail and highways, has carried out studies in railway signal control and computerized ticketing, bridge and structural design innovations, and transportation automation control. In March 2003, the university signed a joint education program agreement with Iowa State University to further international scientific research, cooperation, and academic exchanges.

From left: Ren Enen, University President; translator; Zhang Wei, Dean of College of Architecture and Urban Planning; Zhang Youping, Director of International Exchange and Cooperation Office; Chen Xingchong, Dean of College of Civil Engineering; Gai Yucian, Director of Administration Office; TRB Executive Director Robert Skinner, Jr.; and Robert Reilly, Director of Cooperative Research Programs.

COOPERATIVE RESEARCH PROGRAMS NEWS

Predicting Performance of Flexible Pavements

The use of accelerated pavement testing (APT) for determining pavement response and performance has increased in recent years primarily because APT can apply wheel loads in a compressed time period, expediting evaluations of potential materials, designs, and features. The short duration and controlled conditions of APT tests, however, do not accurately account for the long-term effects of environment and aging of materials.

In addition, the magnitude, duration, and configuration of the loads applied in APT studies often differ substantially from those imposed by traffic on in-service pavements. Methodologies that relate data from APT studies to in-service performance are not readily available. For these reasons and to enhance the benefits of APT studies, research is needed to identify or develop methodologies for using results from APT studies to predict long-term, in-service pavement performance.

J. B. Metcalf of Baton Rouge, Louisiana, has been awarded a $100,000, 9-month contract [National Cooperative Highway Research Program (NCHRP) Project 10-66, FY 2003] to conduct Phase I of the project and develop a research plan either for validating available or modified methods or for developing and validating new methods to use APT results to predict long-term, in-service pavement performance. The research will focus on applying the results of APT studies under specific environmental, aging, and loading conditions, to establish the expected pavement performance under in-service traffic and environmental conditions.

The research will deal with new and rehabilitated flexible pavements, but not with pavements resurfaced with portland cement concrete overlays. The research plan will be executed in a subsequent phase that will recommend methodologies for relating APT results to in-service performance.

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

SETTING A RESEARCH AGENDA—The American Association of State Highway and Transportation Officials Standing Committee on Research (SCOR) held a three-day meeting in Washington, D.C., in March to allocate funding for NCHRP projects for FY 2005. Out of 168 project requests totaling $66.4 million, the committee provided $12.4 million to continue 25 projects, $12.7 million to fund 35 new projects, and $2.4 million for 6 contingent projects. The highway research areas assigned the most projects include traffic safety, bridge design, traffic operations and control, materials, and transportation planning.

From left: SCOR Vice Chair Wesley Lum, California DOT, and SCOR Chair Kam Movassaghi, Louisiana Department of Transportation and Development, listen to a report given by Robert

TRB Meetings 2002

May

23–26 10th International Conference on Mobility and Transport for Elderly and Disabled People*
Hamamatsu, Japan
Claire Felbinger

23–26 Ports 2004: Port Development in the Changing World and TRB Midyear Committee Meetings*
Houston, Texas
Joedy Cambridge

26–28 8th International Conference on Applications of Advanced Technologies in Transportation*
Beijing, China

June

7–9 6th International Symposium on Snow Removal and Ice Control Technology
Spokane, Washington

27–30 North American Travel Monitoring Exposition and Conference 2004
San Diego, California

July

14–17 Geometric Design Midyear Meeting and Workshop
Williamsburg, Virginia

18–21 43rd Annual Workshop on Transportation Law
Savannah, Georgia
James McDaniel

21–24 Highway Capacity and Quality of Service Committee Midyear Meeting and Conference
State College, Pennsylvania
Richard Cunard

25–27 Joint Summer Meeting of the Planning, Economics, Environmental, Finance, Freight, and Management Committees
Park City, Utah
Elaine King

August

2–4 Removing Water from Within Pavement Structures
Sacramento, California

12 Workshop on Transit Capacity and Quality of Service
Vancouver, British Columbia, Canada
Peter Shaw

21–26 National Community Impact Assessment Conference*
Portland, Maine
Claire Felbinger

22–24 Performance Measures to Improve Transportation Systems: 2nd National Conference
Irvine, California
Kimberly Fisher

29–Sept. 1 6th National Meeting on Access Management
Kansas City, Missouri
Kimberly Fisher

September

7 Geotechnical Methods Revisited
Kansas City, Missouri
G.P. Jayaprakash

7–10 Pro Walk–Pro Bike*
Victoria, British Columbia, Canada
Richard Pain

8 Creating Rural Freight Transport Opportunities in a Global Market*
Minneapolis, Minnesota
Joedy Cambridge

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

Additional information on TRB conferences and workshops, including calls for abstracts, registration and hotel information, lists of cosponsors, and links to conference websites, is available online (www.TRB.org/calendar). Registration and hotel information usually is available 2 to 3 months in advance. For information, contact the individual listed at 202-334-2934, fax 202-334-2003, or e-mail lkarson@nas.edu/. Meeting listings without TRB staff contacts have direct links from the TRB calendar web page.

*TRB is cosponsor of the meeting.

Acceptability of Transport Pricing Strategies
Edited by Jens Schade and Bernhard Schlag, Elsevier Science Ltd. 2003; 340 pp.; $95 hardcover; 0-08-044199-8.

This volume provides an interdisciplinary examination of transport pricing strategies as a solution for urban traffic congestion. Contributors from the fields of psychology, economics, civil engineering, sociology, and political science explore the determinants of pricing acceptability and how to overcome the lack of public and political acceptance. The book gathers the most advanced state-of-the-art information and proposes forthcoming and possible solutions for implementing different kinds of travel demand management measures, including pricing. The papers were presented at the Marginal Cost Pricing in Transport: Integrated Conceptual and Applied Model Analysis Conference on Acceptability of Transport Pricing Strategies, held in Dresden, Germany, May 23—24, 2002.

Six-Minute Solutions for Civil PE Exam Transportation Problems
Norman R. Voigt, Professional Publications, Inc. California: 2004; 96 pp.; $34.95 paperback; 1-59126-011-6.

The workbook offers 100 practice problems with solutions covering the range of transportation topics that may appear on the Principles and Practice of Civil Engineering exam (PE), administered by the National Council of Examiners for Engineering and Surveying. Traffic analysis, construction, and geometric design problems are included in the 20 morning, breadth-style problems, and there are several transportation problems in the structural and geotechnical afternoon, depth-style units. The book helps engineers streamline solving skills and improve performance on the exam, which allows an average of six minutes per problem.

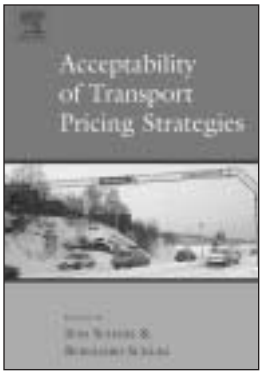
Transportation: A Geographical Analysis
William R. Black, The Guilford Press. New York: 2003; 375 pp.; $65 hardcover; 1-57230-848-6.

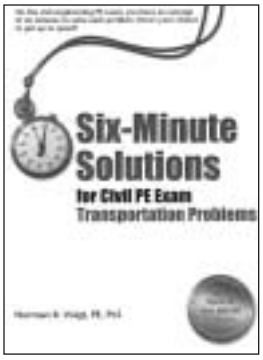
Black, active on TRB Planning and Environment Group committees and task forces, the International Activities Committee, and National Cooperative Highway Research Program project panels, provides an authoritative introduction to transportation geography. The textbook provides history, definitions, and core concepts in the field, as well as models for analyzing transportation networks and flows between regions. Environmental, economic, and social issues in transportation planning and policy are addressed, and the uses of geographic information systems in transport (GIS-T) are discussed in detail. Although focusing on the United States, the volume includes problems and trends in Europe and other parts of the developed world.

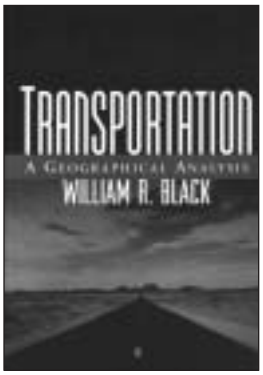
Safe Handling of Hot Asphalt
Asphalt Institute. Kentucky: 2004; 20 pp. workbook with accompanying video on VHS or DVD format; $40.

The 18-minute video presentation depicts the best practices for safely loading, transporting, unloading, and storing hot asphalt. Developed by Asphalt Institute s Health, Safety, and Environment Committee, the training program covers potential hazards, such as burns, spills, falls, explosions, overfills, and contamination; demonstrates proper protective equipment to safely load hot asphalt into a tanker truck; and presents tips for the safe transport and storage of hot asphalt. The accompanying workbook includes testing material and reference information.

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





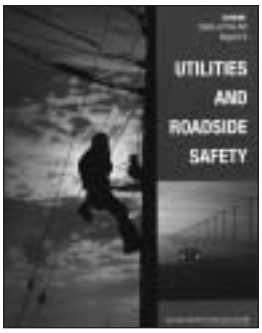


TRB PUBLICATIONS

Moisture Sensitivity of Asphalt Pavements: A National Seminar

The proceedings from a February 2003 conference in San Diego identify best practices, gaps in knowledge, and research needs on moisture damage in asphalt pavements. The topics addressed in the report cover problem identification and distinctions between materials-induced and construction-related factors, binder and aggregate considerations and failure mechanisms, laboratory and field test methods, additives and construction practices, field performance and case studies, specifications, and environmental and health issues. In addition to the papers and breakout session summaries, the proceedings include questions raised and answers given by some of the more than 100 participants.

2003; 360 pp.; TRB affiliates, $42.75 soft cover, $26.25 CD-ROM, $51.75 soft cover and CD-ROM set; nonaffiliates, $57 soft cover, $35 CD-ROM, and $69 soft cover and CD-ROM set.



Utilities and Roadside Safety
State of the Art Report 9
Produced by the TRB Committee on Utilities, this report includes the latest information on roadside safety programs by utility companies, state departments of transportation, and local highway agencies; describes the current status of a combined federal and industry effort to implement roadside safety, including yielding poles; and documents recent developments in guardrail, concrete barrier, and crash cushion design to reduce utility maintenance costs, potential liability, and public health costs.

2004; 68 pp.; TRB affiliates, $16.50; nonaffiliates, $22.

Freight Policy, Economics, and Logistics: Truck Transportation
Transportation Research Record 1833
This two-part volume presents a road transportation and trade facilitation strategy for Central Asia, an evaluation of freight transportation policy in Illinois, and an assessment of pipeline adequacy to meet natural gas demand in New York State in Part 1; and the perceived benefits of congestion pricing for trucks, the economic and financial feasibility of truck toll lanes, and the effects of truck driver wages and working conditions on highway safety in Part 2.

2003; 102 pp.; TRB affiliates, $31.50; nonaffiliates, $42. Subscriber category: freight transportation (multimodal) (VIII).

Concrete 2003
Transportation Research Record 1834
Included are a Michigan case study into the deterioration of concrete pavements constructed with slag coarse aggregate, an analysis of the mechanical properties and durability of several plain and fiber-reinforced concrete-overlay mixes, an examination of a restrained-ring test that quantifies stress development and cracking in low water-to-cement concrete, and an assessment of concrete drying-shrinkage performance specifications for mixtures purchased by the Virginia Department of Transportation, and more.

2003; 106 pp.; TRB affiliates, $33; nonaffiliates, $44. Subscriber category: materials and construction (IIIB).

Transit: Planning and Development, Management and Performance, Marketing and Fare Policy, and Intermodal Transfer Facilities
Transportation Research Record 1835
The accessibility, connectivity, and captivity of transit are addressed through case studies: transit use at large employment sites in San Francisco; the value of new heavy rail and bus rapid transit projects in Lima, Peru; the implementation of a transit priority program in Zurich, Switzerland; and the fare-free transit program at the University of California—Los Angeles.

2003; 136 pp.; TRB affiliates, $34.50; nonaffiliates, $46. Subscriber category: public transit (VI).

Initiatives in Information Technology and Geospatial Science for Transportation
Transportation Research Record 1836
Included in this volume is research into uses of light detection and ranging technology to speed up highway location and design activities (in conjunction with photogrammetric mapping) and to collect highway intersection safety information. Also presented are approaches to optimize traffic information services and short-term traffic prediction, as well as methods to store and retrieve intelligent transportation system data more efficiently.

2003; 156 pp.; TRB affiliates, $36; nonaffiliates, $48. Subscriber category: planning and administration (IA).

Geomaterials 2003
Transportation Research Record 1837
This three-part volume covers soil stabilization, modeling of granular bases for flexible pavement, and aggregate testing and characterization. Paper topics include the difficulties and successes in measuring sulfate in subgrade soil; a field evaluation of the stiffness of unbound aggregate base layers in inverted flexible pavements; and the refinement and validation of the hydraulic fracture test.

2003; 88 pp.; TRB affiliates, $31.50; nonaffiliates, $42. Subscriber category: soils, geology, and foundations (IIIA).

Transit: Rail Transit, Commuter Rail, Light Rail Transit, Major Activity Center Circulation Systems, New Technology, and Maintenance
Transportation Research Record 1838
Among the topics examined are customer perspectives on proposed designs for multilevel coaches in New Jersey Transit commuter trains; justifications for commuter rail reelectrification; a three-stage effort to reallocate empty personal rapid transit vehicles to reduce average waiting times; and a new approach to effective and sustainable urban transport with personal rapid transit.

2003; 80 pp.; TRB affiliates, $30; nonaffiliates, $40. Subscriber category: public transit (VI).

Transportation Finance, Economics, and Development 2003
Transportation Research Record 1839
Part 1 consists of the 2003 presentation in the annual distinguished lecture series renamed in honor of former TRB Executive Director Thomas B. Deen. Deen, the 2003 recipient, discusses the challenge for the U.S. government to create transportation policy that does not significantly burden the private-sector market. The papers in Part 2 include results of a driver survey of the use of side lanes to bypass traffic at intersections; the acceptability of transport pricing measures among the public and professionals in Europe; and the impact on travel time along I-15 in San Diego as a result of a 3-year congestion pricing project.

2003; 190 pp.; TRB affiliates, $37.50; nonaffiliates, $50. Subscriber category: planning and administration (IA).

Statistical Methods and Modeling and Safety Data, Analysis, and Evaluation
Transportation Research Record 1840
Empirical approaches to outlier detection in intelligent transportation systems data, modeling of traffic crash—flow relationships for intersections, profiling of high-frequency accident locations by use of association rules, analysis of rollovers and injuries with sport utility vehicles, and automated accident detection at intersections via digital audio signal processing are among the topics of research in this volume.

2003; 197 pp.; TRB affiliates, $39; nonaffiliates, $52. Subscriber category: safety and human performance (IVB).

Transit: Bus, Paratransit, Rural Public and Intercity Bus, New Transportation Systems and Technology, Capacity and Quality of Service
Transportation Research Record 1841
This volume includes an assessment of urban bus needs in Illinois; recommendations for consolidating single-county rural public transportation systems into regional multicounty transit systems in North Carolina; an evaluation of a web-based software program that assists New Mexico human services agencies in improving clients rural public transportation options; and statewide coordination of van transportation by social service agencies to serve the elderly, people with mental illness, or those in poverty and looking for work.

2003; 134 pp.; TRB affiliates, $34.50; nonaffiliates. $46. Subscriber category: public transit (VI).

Energy, Air Quality, and Fuels 2003
Transportation Research Record 1842
Authors of papers in this volume describe how future technologies may improve fuel consumption of heavy-duty trucks; provide analysis of alternative forms of automotive fuel economy standards; summarize the New York Greenhouse Gas Task Force recommendations for reducing the impacts of transportation on global warming; and consider transitions to alternative-fuels and hybrid engines for light-duty vehicles.

2003; 134 pp.; TRB affiliates, $34.50; nonaffiliates, $46. Subscriber category: energy and environment (IB).

Traffic Control Devices, Visibility, and Rail—Highway Grade Crossings 2003
Transportation Research Record 1844
Papers report on findings that travel speeds near highway work zones are more likely to decrease with dancing diamond displays than with flashing box displays; that supplemental pavement markings improve safety at railroad—highway grade crossings; and that driving simulators should be considered in conducting driver comprehension analyses of protected—permissive left-turn signal displays.

2003; 102 pp.; TRB affiliates, $31.50; nonaffiliates, $42. Subscriber category: highway operations, capacity, and traffic control (IVA).

Soil Mechanics 2003
Transportation Research Record 1849
This six-part volume examines issues related to transportation earthworks; fiber-reinforced polymer piles, deep foundations, and advances in load and resistance factor design; thermoplastic pipe design and performance; spatial variability in pavement engineering; recent advances in geotechnical engineering; and geosynthetic reinforcement in roads.

2003; 230 pp.; TRB affiliates, $40.50; nonaffiliates, $54. Subscriber category: soils, geology, and foundations (IIIA).

Roadside Safety Analysis Program (RSAP): Engineer s Manual
NCHRP Report 492
Roadside safety devices are intended to decrease the risk of death or injury for the motoring public; however, the cost of installing and maintaining a device also must be considered. This report presents an improved, cost-effective analysis procedure for assessing roadside safety improvements the Roadside Safety Analysis Program (RSAP). RSAP integrates a main analysis program, which contains the cost-effectiveness procedure and algorithms, with a

user interface program, which provides a user-friendly environment for data input and review of program results. An accompanying CD-ROM contains a user s manual and the RSAP software.

2003; 66 pp. plus CD-ROM; TRB affiliates, $22.50; nonaffiliates, $30. Subscriber categories: highway and facility design (IIA); safety and human performance (IVB).

Evaluation of Traffic Signal Displays for Protected/Permissive Left-Turn Control
NCHRP Report 493
Recommendations are provided for traffic signal displays for protected—permissive left-turn control. The recommendations stem from a comprehensive evaluation of the safety and effectiveness of alternative traffic signal displays and phasing in laboratory and field studies. The report summarizes the studies, and the accompanying CD-ROM includes more detailed information. The recommendations are being submitted for consideration in the next edition of the *Manual on Uniform Traffic Control Devices*.

2003; 83 pp. plus CD-ROM; TRB affiliates, $23.25; nonaffiliates, $31. Subscriber category: highway operations, capacity, and traffic control (IVA).

Structural Supports for Highway Signs, Luminaires, and Traffic Signals
NCHRP Report 494
This report includes recommended revisions for the *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, issued by the American Association of State Highway and Transportation Officials (AASHTO). The report describes the research effort and provides recommendations for updating and refining the specifications. Also included is a strategic plan to enhance the specifications, as well as to convert the specifications into the load and resistance factor format.

2003; 50 pp.; TRB affiliates, $14.25; nonaffiliates, $19. Subscriber category: bridges, other structures, and hydraulics and hydrology (IIC).

Effect of Truck Weight on Bridge Network Costs
NCHRP Report 495
Increased truck weights cause more frequent maintenance and repair to bridges, which must remain at an acceptable service level. Bridge owners need a method for estimating network maintenance and repair costs. This report recommends methods for estimating changes in truck-weight histograms and for calculating the cost of fatigue and overstress in bridge components. To automate the methodology, a software module that can be integrated with AASHTO BRIDGEWare is included on an accompanying CD-ROM, along with a user s manual and application examples.

2003; 187 pp. plus CD-ROM; TRB affiliates, $26.25; nonaffiliates, $35. Subscriber category: bridges, other structures, and hydraulics and hydrology (IIC).

Prestress Losses in Pretensioned High-Strength Concrete Bridge Girders
NCHRP Report 496
This report shows bridge engineers who are developing economical designs how to obtain realistic estimates of prestress losses in high-strength, pretensioned concrete bridge girders. The guideline procedures yield more accurate predictions of modulus of elasticity, shrinkage, and creep of concrete and more realistic estimates of prestress losses than do the current specification s procedures. The new procedures are recommended for adoption by AASHTO as part of the load and resistance factor design specifications for bridges.

2003; 63 pp.; TRB affiliates, $14.25; nonaffiliates, $19. Subscriber categories: bridges, other structures, and hydraulics and hydrology (IIC); materials and construction (IIIB).

Strategies for Improved Traveler Information
TCRP Report 92
This report considers ways of improving transit traveler information (TTI) for current and potential customers, identifies TTI needs, assesses the state of the art in providing TTI, provides examples of customer information systems in the transit and related industries, discusses TTI as part of larger community information systems, and offers new directions for the transit industry in providing traveler information.

2003; 112 pp.; TRB affiliates, $16.50; nonaffiliates, $22. Subscriber category: public transit (VIA).

Travel Matters: Mitigating Climate Change with Sustainable Surface Transportation
TCRP Report 93
After presenting information on climate change, this report examines how to reduce greenhouse gas emissions from transportation, specifically from public transit sources. Key strategies are discussed, for example, increasing the use of transit, changing land-use patterns, and adopting energy-efficient technologies and fuels in transit fleets. The TravelMatters website, www.travelmatters.org, was developed in conjunction with this report.

2003; 77 pp.; TRB affiliates, $15; nonaffiliates, $20. Subscriber categories: planning and administration (IA); public transit (VI).

Fare Policies, Structures, and Technologies: Update
TCRP Report 94
Focusing on the impacts on customers, operations management, and effective and equitable fare integration, this report evaluates the key fare structures, policies, and technologies under consideration at transit agencies. The research includes data on fare structures, policy-making procedures, and ongoing efforts to implement fare technology. Also presented is updated information from *TCRP Reports 10* and *32*, along with guidance for making decisions about fare policies and technologies. The report includes 13 case studies.

2003; 228 pp.; TRB affiliates, $20.25; nonaffiliates, $27. Subscriber category: public transit (VI).

Traveler Response to Transportation System Changes, Chapter 14: Road Value Pricing
TCRP Report 95, Chapter 14
The *TCRP Report 95* series comprehensively documents various transportation system changes, policy actions, and alternative land-use and site-development design approaches. This third edition of *Traveler Response to Transportation System Changes* covers 18 topic areas including 9 new areas each published as a chapter. Chapter 14 focuses on automobile-based pricing, excluding parking. The emphasis is on area-wide, corridor, and individual facility pricing schemes for urbanized areas. The static pricing of toll roads and an example of an intercity value pricing project also are examined.

2003; 67 pp.; TRB affiliates, $15; nonaffiliates, $20. Subscriber categories: planning and administration (IA); public transit (VI); highway operations, capacity, and traffic control (IVA).

Determining Training for New Technologies: A Decision Game and Facilitation Guide
TCRP Report 96
The public transit industry is adopting new technologies, some of which are industry-specific, but many, such as the Global Positioning System and Internet applications, are used in other industries. Training is essential for forward-thinking transit managers who are seeking to adopt mainstream methods and technologies. The guide and game that constitute TCRP Report 96 simulate the experience of making key decisions about training during the implementation of new technologies. The report also includes a decision matrix and a template.

2003; 39 pp.; TRB affiliates, $13.50; nonaffiliates, $18. Subscriber categories: planning and administration (IA); public transit (VI).

Compensation for Contractors Home Office Overhead
NCHRP Synthesis 315
Compensating contractors for unabsorbed home office overhead is one of the most controversial issues affecting the development of transportation infrastructure projects. To explain the issue, the report presents the perspectives of the contractor and the state departments of transportation (DOTs).

The report examines the approaches taken by state DOTs to compensate contractors for unabsorbed home office overhead for contract delays. The approaches include the use of formulas, percentages, specification provisions, dispute resolution procedures, and audits. The advantages and disadvantages of each approach are reviewed from the perspective of the owner and the contractor. The report also reviews how the federal government and the private sector are addressing the issue.

2003; 47 pp.; TRB affiliates, $11.25; nonaffiliates, $15. Subscriber category: Planning and Administration (IA); Materials and Construction (IIIB); Transportation Law (IC).

Design Exception Practices
NCHRP Synthesis 316
Nearly all highway and street construction and improvement projects by a state transportation agency (STA) are designed to conform to agency-adopted geometric design standards. In some situations, however, conforming to all design criteria is not always practical or reasonable. The decision to deviate from an applicable criterion is called a design exception.

Because design exception practices differ among states and agencies, this synthesis reviews the dominant and unique practices for conditions that require a design exception, data collection and analysis techniques, and internal STA and external roles. The synthesis also reports on the benefits and problems that STAs experience and identifies suggestions for improving the design exception process.

2003; 82 pp.; TRB affiliates, $12; nonaffiliates, $16. Subscriber categories: Transportation Law (IC); Soils, Geology, and Foundations (IIIA); Materials and Construction (IIIB); Maintenance (IIIC).

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TR News welcomes the submission of manuscripts for possible publication in the categories listed below. All manuscripts submitted are subject to review by the Editorial Board and other reviewers to determine suitability for *TR News*; authors will be advised of acceptance of articles with or without revision. All manuscripts accepted for publication are subject to editing for conciseness and appropriate language and style. Page proofs will be provided for author review and original artwork returned only on request.

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.

SUBMISSION REQUIREMENTS Manuscripts submitted for possible publication in *TR News* and any correspondence on editorial matters should be directed to the Director, Publications Office, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, telephone 202-334-2972 or email jawan@nas.edu. All manuscripts must be submitted in duplicate, typed double-spaced on one side of the page and accompanied by a word-processed diskette in Microsoft Word 6.0 or Word Perfect 6.1 or higher versions. Original artwork must be submitted. Glossy, high-quality black-and-white photographs, color photographs, and slides are acceptable. Digital continuous-tone images must be submitted as TIF or JPG files and must be at least 3 in. by 5 in. with a resolution of 300 dpi or greater. Any graphs, tables, and line art submitted on disk must be created in Adobe Illustrator or Corel Draw. A caption must be supplied for each graphic element submitted. Required style for units of measurement: The International System of Units (SI), an updated version of the metric system, should be used for the primary units of measurement. In the text, the SI units should be followed, when appropriate, by the U.S. customary equivalent units in parentheses. For figures and tables, use only the SI units, providing the base unit conversions in a footnote.

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Improving Transportation Security

Since September 11, 2001, citizens and government have looked to the scientific and engineering research community to develop faster and more effective ways to detect, thwart, and respond to terrorist attacks on the transportation system. The Transportation Research Board (TRB) has assembled and published extensive information on ways to enhance the nation s transportation security. In addition to a wide-ranging Transportation System Security website (http://www4.trb.org/trb/homepage.nsf/web/ security), TRB has developed a bookshelf of resources and guides for transportation professionals, decision makers, and members of the general public. Recent TRB publications of interest include the following:

Intrusion Detection for Public Transportation Facilities Handbook
Transit Cooperative Research Program (TCRP) Report 86D: Public Transportation Security, Volume 4, ISBN 0-309-06760-X, 160 pages, 8.5 x 11, paperback (2003)

Transportation Security and Infrastructure Protection
Transportation Research Record: Journal of the Transportation Research Board, No. 1822, ISBN 0-309-08554-3, 55 pages, 8.5 x 11, paperback (2003)

Security Measures in the Commercial Trucking and Bus Industries
Commercial Truck and Bus Safety Synthesis Program Synthesis 2, ISBN 0-309-08755-4, 48 pages, 8.5 x 11, paperback (2003)

Cybersecurity of Freight Information Systems: A Scoping Study
Special Report 274, ISBN 0-309-08555-1, 80 pages, 6 x 9, paperback (2003)

A Guide to Public Transportation Security Resources
TCRP Research Results Digest 59, 20 pages, 8.5 x 11, paperback (2003)

Robotic Devices: A Guide for the Transit Environment
TCRP Report 86C: Public Transportation Security, Volume 3, ISBN 0-309-06760-X, 23 pages, 8.5 x 11, paperback (2003)

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TCRP Report 86B: Public Transportation Security, Volume 2, ISBN 0-309-06760-X, 120 pages, 8.5 x 11, paperback (2002)

Communication of Threats: A Guide
TCRP Report 86A: Public Transportation Security, Volume 1, ISBN 0-309-06760-X, 42 pages, 8.5 x 11, paperback (2002)

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