TR News: January-February 2006 New York City's Subway Century

DETAILS

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COVER: Marking the 100th anniversary of the New York City subway system, October 27, 2004 (*in center window, left to right:*) New York Lt. Governor Mary Donohue, Metropolitan Transit Authority Chairman Peter S. Kalikow, and Mayor Michael Bloomberg ride an antique subway car through the restored City Hall station, the original system's first stop. (Photo by Mike Segar, Reuters)

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

How can researchers find the fast lanes on the transportation information superhighway? Articles in the March–April *TR News* offer practical pointers and new directions. Photographic highlights and summary reports from TRB's 85th Annual Meeting round out the issue.

CABLE RISDON

U.S. Secretary of Transportation Norman Mineta cuts the ribbon to inaugurate the national celebration of the 50th anniversary of the Interstate Highway System, January 23, at the American Association of State Highway and Transportation Officials (AASHTO) exhibit at the TRB 85th Annual Meeting. Participants include (*front row, left to right*:) William W. Millar, American Public Transportation Association; Gary Ridley, Oklahoma Department of Transportation (DOT); Gloria Jean Jeff, Michigan DOT; Robert E. Skinner, Jr., TRB; Secretary Mineta; John C. Horsley, AASHTO; and T. Peter Ruane, American Road and Transportation Builders Association.

Photo by Mike Segar, Reuters

NEW YORK CITY'S SUBWAY CENTURY

Rail Transit's Role in Growth and Development

THOMAS R. JABLONSKI

The author is Deputy Chief Planner, Department of Capital Program Management, New York City Transit.

(*Photo above:*) Subway train prepares to leave Times Square 42nd Street station, October 27, 2004—the 100th anniversary of the system's opening.

The subway has shaped New York City. More than any other public works program or municipal project, the subway has shaped the city's development and sustained its global competitiveness over the past 100 years. The subway's profound impact on the city's growth and development—particularly in the outer boroughs—surpasses that of the city's other widely acclaimed infrastructure projects, such as the Brooklyn Bridge and Robert Moses' highway network.

The innovative, early 20th century transit system still serves the 21st century metropolis well—a tribute to visionary planning and advanced engineering design. The October 2004 centennial of New York's first subway line provides an occasion to look back at how dramatically the city was transformed in the years that the subways were built.

Forging a Vision

New York City's rapid transformation into the leading metropolis of the United States was linked inextricably to improvements in the transportation infrastructure that overcame a challenging geography. An urban archipelago, New York capitalized in the early 19th century on an unusually good system of rivers and bays to grow from a settlement of 60,000 clustered in southern Manhattan to a booming port city of almost 3.5 million by 1900, when it was second in the world only to London.

Establishing itself as the nation's leading financial center and a magnet for business and employment, New York faced a troubling paradox. The most congested and populous city was attracting ever-increasing numbers of immigrants. Yet at the same time, the waterways that had spurred the city's initial success had become the most serious impediment to sustained

PARSONS BRINCKERHOFF

Traffic, transit, and pedestrians on the Bowery, in Manhattan's Lower East Side, circa 1899.

growth by severely limiting the areas where people could live within a practical commute to jobs.

To serve the booming population, early forms of rapid transit emerged in the 19th century. Many of these transit modes—including horse cars, cable cars, electric trolley cars, and elevated steam trains—began to change conventional notions of commuting distance and time. The opening of the Brooklyn and Williamsburg Bridges to transit operations also facilitated these changes.

But no change would be as radical and quick as that introduced by the underground, electrically powered subway system, which began operating in 1904. The first subway, however, was severely overcrowded from the day it opened and was too limited in geographical coverage to relieve the city's population congestion.

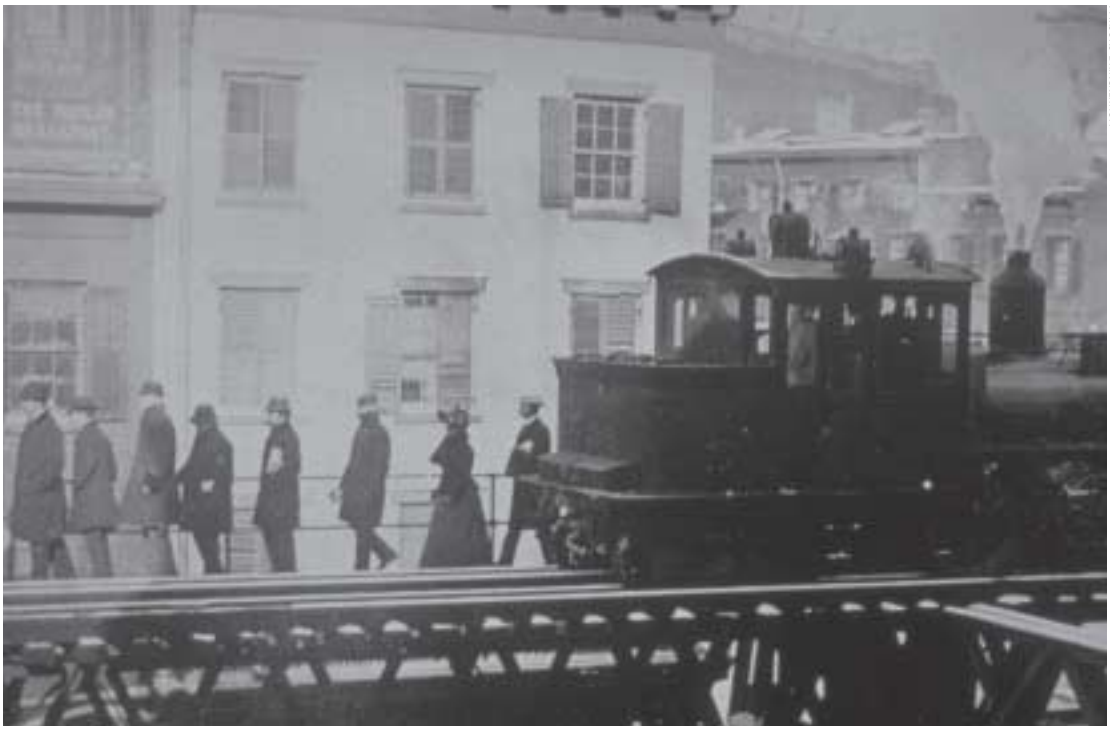
Visionary municipal leaders saw that New York's continued economic success and prosperity could lead to its downfall without managed growth. These leaders promoted construction of a more extensive citywide subway network to serve as an instrument of modern city planning efforts to rationalize urban development. The plan benefited New York City to a far greater extent than could have been imagined.

The subway influenced New York City's growth and development by improving the quality of life for a range of citizens, by spurring commercial development and the creation of the skyscraper skyline, and by increasing real estate values and broadening the city's tax base.

Catalyst for Residential Development

Between 1900 and 1910, most of New York City's population was concentrated in older, severely overcrowded tenement districts. The largest, Manhattan's Lower East Side, was within walking distance of the thread-and-needle trades and light industries and had the highest population density in the world.

Other tenement districts had been built along the old 19th century elevated steam railways and the first subway in such areas as Harlem, Hell's Kitchen, the



PARSONS BRINCKERHOFF

Sixth Avenue elevated train breaks down, circa 1901.

South Bronx, and Brooklyn's Williamsburg and Bushwick neighborhoods. New immigrants, many from southern and eastern Europe, continued to crowd into a limited supply of low-quality tenement buildings in these districts.

The tenements lacked natural light and fresh air flow, and the cramped apartments did not have hot running water or private bathrooms. Contagious diseases and a variety of criminal activities proliferated. This bleak situation persisted despite the availability of vast expanses of open or underdeveloped land in other parts of Greater New York.

Manhattan's average population density in 1910 was 189 residents per acre (RPA), compared with Brooklyn (45 RPA), the Bronx (21 RPA), and Queens (5 RPA). These less crowded sections composed nearly three-quarters of Greater New York's land area but housed less than 20 percent of its population, because the daily commuting time and cost to and from Manhattan's employment districts were not practical.

The threats from population congestion to the wider society spurred the massive expansion of New York's subway system between 1913 and 1940. During this era, the city built 180 route-miles of subway lines—including 12 bridge and subaqeous tunnel crossings—effectively overcoming the river barriers to integrate Manhattan geographically with Brooklyn, Queens, and the Bronx.

As a result, a greater amount of land was opened for development than at any other time in the city's history. Developers followed the new subway lines and extensions to construct decent, affordable, low-density housing for middle-class and working-class families. The bucolic, rural landscape of the city's outlying areas was quickly replaced by long rows of tree-shaded streets with a mix of apartment houses, private single- and two-family homes, and open recreational spaces.

The expanded subway's low-cost five-cent fare, devalued by significant inflation during World War I, was within the reach of even the poorest person in the city. This was the primary catalyst for the development of new residential neighborhoods in the outer boroughs, allowing dispersal of the city's growing population.

Most of the city's net population growth from 1910 to 1940 occurred within the new transit-oriented developments, as the population density outside of Manhattan increased with the construction of new subway lines (Figure 1). The city's population rose steadily until about 1930, when the Interborough Rapid Transit (IRT) and Brooklyn-Manhattan Transit (BMT) subway lines were largely completed. Growth continued at a slower rate until 1940, as the Independent (IND) subway lines were built.

PRINCETON UNIVERSITY LIBRARY

1925 transit information poster published by the Interborough Rapid Transit Company, placed the 1904 opening of New York's first subway in its proper historical context.

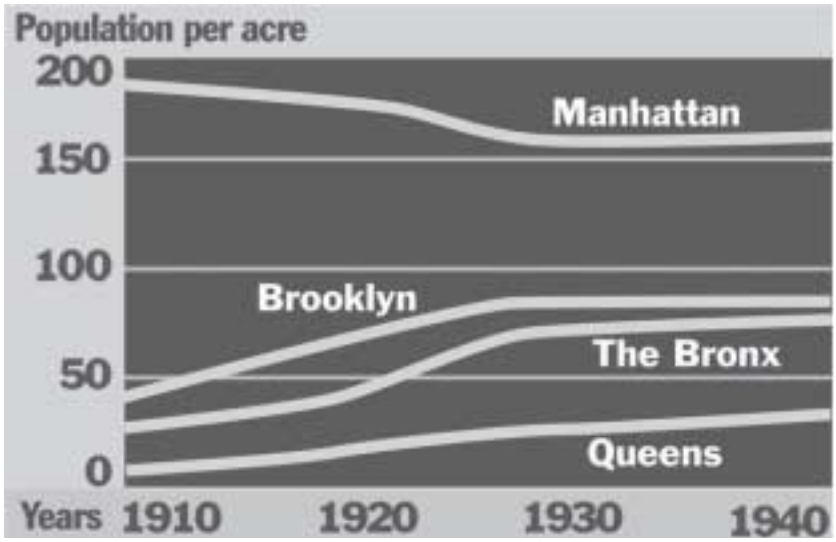
The IRT and BMT lines reached into undeveloped areas; the IND reinforced many lines already in service. By 1940, nearly 90 percent of the city's population of 7.5 million lived within one-half mile of a subway or an elevated rapid transit line.

By reducing the early 20th century problems of population congestion, the subway improved the quality of life for New Yorkers—an enduring legacy.

Building a Vertical City

Four technological innovations of the late 19th century enabled the skyscraper—the "ultimate architecture of capitalism" and the symbol of New York's financial preeminence—to dominate Manhattan's skyline. These were the passenger elevator; metal-skeleton construction, which replaced load-bearing masonry walls with cast iron and later with structural steel; electric power and light; and rapid transit.

FIGURE 1 Population follows transportation: the opening of new subway lines relieved overcrowding by shifting population density and growth to the outer boroughs.



MTA NEW YORK CITY TRANSIT

MTA New York City Transit

The extension of the Flushing Line along Queens Boulevard, shown at Rawson Street in 1917, completely changed the rural landscape of Queens, spurring intense residential, commercial, and industrial development.

Pivotal in spreading out the city's residential areas geographically, the subway also played a role in New York's development into a vertical city of skyscrapers. The subway made possible an extraordinary density of daytime worker populations in Manhattan's central business districts—the subway's capacity, speed, and affordability enabled hundreds of thousands of people to commute to jobs in Manhattan; moreover, the subway provided Manhattan-based businesses with access to labor, influencing continued growth.

When the subway opened in 1904, Lower Manhattan already was the world's largest office building district, served by earlier forms of rapid transit, including the Manhattan elevated steam railways and the Brooklyn Bridge's elevated cable railway. With the construction of additional subway lines in Lower Manhattan, more and taller office buildings were built to meet the demand for office space in prime locations.

With the completion of the IRT and BMT lines, subway station entrances were near every concentration of employment. Without this accessibility, traffic congestion would have stunted New York's economic growth and development.

Midtown Manhattan's transformation from a fashionable 19th century residential area into a leading retail district began before the first subway opened. In 1902, Macy's Department Store relocated from 14th Street and Sixth Avenue to Herald Square, one block from the planned construction of the Pennsylvania Railroad Station, and other department stores and specialty shops soon followed. The subsequent construction of the IRT and BMT lines, together with the reconstruction and improvement of Grand Central Terminal, added impetus to the northward movement of development.

Throughout the 1920s, although the financial district remained the focus of new office building development, the Midtown area evolved into Manhattan's second central business district. By 1935, the 60 million square feet of office space in Midtown surpassed the 55 million in Lower Manhattan.

Manhattan's signature art deco skyscrapers, the Chrysler and Empire State Buildings, were constructed close to Midtown subway lines. Times Square, at the nexus of several subway lines, quickly developed into the city's premier hotel, theater, and entertainment district and became known as the "crossroads of the world."

The subways brought huge crowds to the skyscrapers and theaters. This type and density of development, in turn, made the need for subways acute.

Broadening the Tax Base

As the subways brought the previously wooded and farmland areas of Brooklyn, Queens, and the Bronx within a reasonable and inexpensive commute to Manhattan's central business districts, the demand for—and value of—the land increased. The accessibility that the subways provided was a primary facilitator, along with a strong regional economy, the market demand for new development, and proactive public policy support.

The greatest rise in values occurred in the previously undeveloped areas of the outer boroughs, as the population followed the construction of new subway lines. By 1935, the average value of land in Brooklyn, Queens, and the Bronx within one-half mile of a subway line was seven times that of land farther away.

In Manhattan, as land became more expensive, new office building developments grew denser and taller to sustain profitability. This necessitated more subways, increasing the land values of commercial development sites adjacent to the new subway stations.

The subway's construction had a redistributive effect on land values in Manhattan. The building of subways after 1913 accelerated Midtown growth, until it outpaced Lower Manhattan in size and importance. New Midtown office developments filled up at the expense of Lower Manhattan's older buildings. Consequently, as more subways were built through each business district, land values increased in Midtown but remained stable in Lower Manhattan.

The construction of the IRT and BMT subway lines provided the accessibility necessary for opening up all parts of the city to development. New York experienced a 160 percent increase in land values during

The subways encouraged Manhattan's dense commercial growth. The city's iconic skyscrapers would have been impractical without the capacity, speed, and affordability of subway service for Manhattan's hundreds of thousands of workers.

the 25-year span from 1905 to 1929. The increased real estate tax revenues financed many other municipal infrastructure improvements, including the construction of the IND subway lines during the 1930s.

Coming Full Circle

When the subway system was largely completed in 1940, the city's growth had reached a maturation point, with a population of 7.5 million and 2.9 million workers—not much different from today's 8.1 million residents and 3.6 million workers. The subway continues to be New York's lifeline, sustaining its economic and physical vitality. Without the subway, it is unlikely that New York would have remained a great city, the world's leading city in finance, commerce, and culture for much of the past century.

At the beginning of the 1980s, New Yorkers experienced life without a safe and reliable subway when the system nearly collapsed after many years of neglect. The Metropolitan Transit Authority (MTA) then embarked on one of the biggest public works rebuilding efforts in American history—a series of capital programs worth more than $40 billion in current dollars—to restore and reinvigorate the infrastructure. The programs began in 1982, and after nearly a quarter of a century of continuous investment, the results of the MTA capital programs are apparent. The dramatically improved subway system has regained passengers in record numbers, making it a primary factor in New York City's resurgence.

In the 21st century, the subway remains crucial to the city in keeping and attracting business, holding and creating jobs, and strengthening the tax base. Continuing the current levels of capital investment is critically important in the capital program for 2005 to 2009 and beyond, to maintain progress and momentum to bring the entire subway system into a state of good repair, helping to ensure safe, reliable, and efficient service. The capital program will make strategic investments in new subway infrastructure to relieve congestion and to open up new areas of the city for development—as was done 100 years ago.

Resources

Derrick, Peter. *Tunneling to the Future: The Story of the Great Subway Expansion That Saved New York.* New York University Press, 2001.

Hood, Clifton. *722 Miles: The Building of the Subways and How They Transformed New York.* Simon and Schuster, New York, 1993.

Law, Edward M. Real Estate Values and Population Growth Along Rapid Transit Lines in the City of New York, *Municipal Engineers Journal,* 1935.

Plant, Irving M. *Population Growth of New York City by Districts, 1910–1948.* Consolidated Edison Company of New York, December 1948.

Spengler, Edwin H. *Land Values in New York in Relation to Transit Facilities.* Columbia University Studies in History, Economics and Public Law, No. 333. Columbia University Press, New York, 1930.

Willis, Carol. *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago.* Princeton Architectural Press, New York, 1995.

THE RENAISSANCE MAN of New York's Subways

William Barclay Parsons, Transportation Engineer Extraordinaire

TOM MALCOLM

The author is an editor in the corporate communications department of Parsons Brinckerhoff, New York. This article is based on a presentation by James L. Lammie, former President and CEO of Parsons Brinckerhoff, at the TRB 84th Annual Meeting, January 2005.

When New York City celebrated the centennial of its subway system in October 2004, no name was invoked more often than that of William Barclay Parsons, who designed the system that opened on October 27, 1904.

One hundred years later, Parsons's design—including his decisions to use cut-and-cover tunneling, third-rail electric power, and a four-track express system—was acknowledged as visionary in anticipating the future growth and needs of New York City. The system Parsons designed provides fast and efficient transportation to those who live in, work in, and visit New York.

Solid Foundations

Parsons was born in New York in 1859 to a prominent family that traced its history to the Revolutionary War. He received most of his early education in Europe. After earning a degree from Columbia College, he enrolled in the Columbia School of Mines, setting the record for the highest grade point average when he graduated in 1882. He then went to work for the Erie Railroad and published two technical manuals, the first of many publications.

Parsons married Anna DeWitt Reed in 1884. The following year, he established a consulting engineering business at 22 William Street in Lower Manhattan, in partnership with his younger brother, Harry de Berke-

Cut-and-cover construction of the subway earned the name "Parsons's ditch."

Photographs courtesy of Parsons Brinckerhoff

ley Parsons, a mechanical engineer. The brothers collaborated on railroads, bridges, water supply systems, and hydroelectric plants. The firm continues today as Parsons Brinckerhoff, with headquarters in New York City and 9,000 employees in 150 offices worldwide.

Subway Dreams

Plans for subterranean mass transit in New York City date to the mid-19th century. In 1870, inventor Alfred Ely Beach built a block-long pneumatic tube subway, powered by a large fan, underneath Broadway. Although the scheme elicited amazement, it was not a practical, large-scale solution to the city's need for mass transit. New York continued to rely on a network of elevated railroads, streetcars, and horse-drawn carriages. Meanwhile, London opened the world's first subway in 1863.

Parsons initially allied with the Arcade Railway group, which offered a plan first proposed in 1866 to create an underground street below Broadway with a four-track rail flanked by sidewalks and stores. Parsons eventually broke away from the Arcade Railway and in 1885 joined the rival New York District Railway.

The District Railway proposed a shallow excavation with an improved ventilation system designed by Parsons. In 1887, New York Mayor Abram S. Hewitt publicly identified Parsons as the leading expert on subways, and when the city formed a Rapid Transit Commission in 1891, Parsons was named deputy chief engineer.

The commission sought bids for its plan but received none. In 1894, the commission reorganized and chose the 35-year-old Parsons as chief engineer—an appointment that met open skepticism from some.

"When I look back now I am glad I was not older," Parsons later remarked. "I doubt if I could now undertake or would undertake such a work under similar conditions….If I had fully realized what was ahead of me, I do not think I would have attempted the work. As it was I was treated as a visionary. Some of my friends spoke pityingly of my wasting my time on what they considered a dream."

Charles T. Harvey, who designed and promoted the West Side and Yonkers Patent Railway, runs a test on Greenwich Street, 1867. The system experienced frequent breakdowns and closed in 1870.

Parsons swings the pickax to start construction on the subway at Bleecker and Greene Streets.

In 1898, before he began work in earnest on the New York City subway, Parsons traveled to China to chart the course of a railroad from Hankow (Wu-Han) to Canton (Guangzhou) through Hunan Province. For a stretch of 500 miles, Parsons was "the first foreigner ever seen," according to his memoir, *An American Engineer in China.*

Parsons also took time to study firsthand the great underground transit systems in operation or planned in Europe. He traveled to London, Paris, and cities in several other countries. This survey convinced him that electric power would be superior to coal-fired steam, and that a system of shallow tunnels built by cut-and-cover construction would be preferable to the deep tunnels of the London Underground. The commission adopted his report as the guiding document for the New York subway.

Parsons's Design

Parsons's plan called for a rapid transit system beginning at City Hall in downtown Manhattan and extending northward through Harlem to Washington Heights and the Bronx. From City Hall, the line proceeded north on the east side to what is now Grand Central Terminal on 42nd Street, then turned west to Times Square and north toward Harlem along the west side.

Below 96th Street, the system employed a four-track system—two tracks for local service and two tracks for express. At 96th Street, one leg continued north to Washington Heights and the Riverdale sec-

Construction of the tunnel under the Harlem River to connect Manhattan and the Bronx used an early version of the immersed tube method.

At Broadway and 125th Street, the first subway line crossed a trussed arch bridge, still standing today.

tion of the Bronx; another leg veered east and terminated near the Bronx Zoo.

The initial system traversed 20.5 miles, including 5 miles of viaduct and 3 miles of deep-bore tunnel. Most of the line was built with cut-and-cover construction—workers dug a shallow trench, removed or rerouted the utilities, covered the trench, and built a rectangular box for the subway underneath.

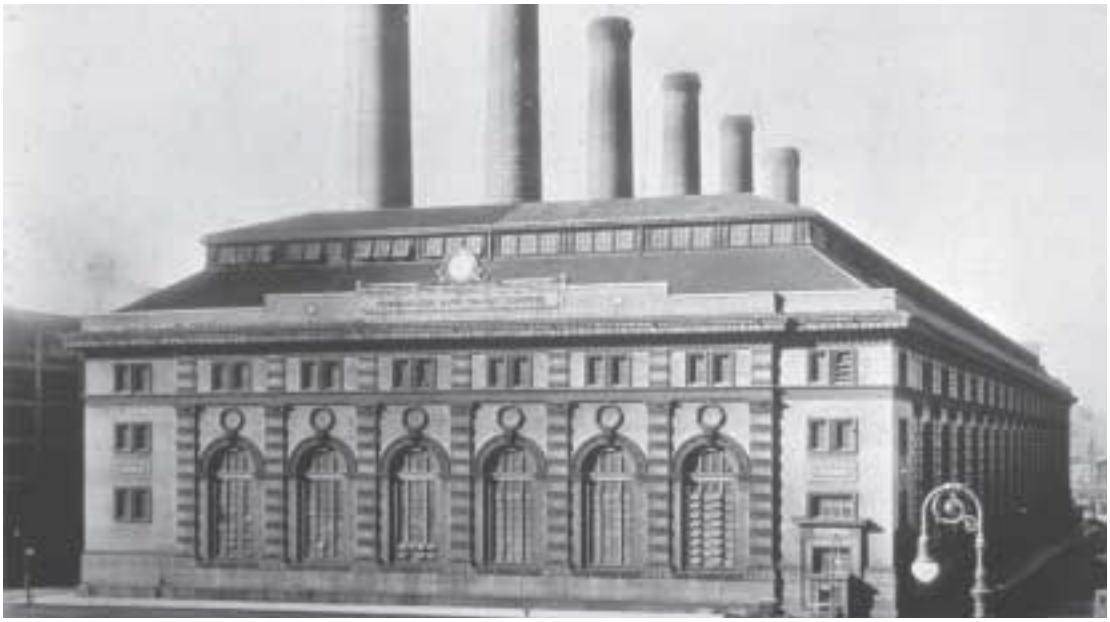
Although it was the preferred construction method, cut-and-cover disrupted normal life and commerce. During construction, the subway was derided as "Parsons's ditch." More than 3 million cubic yards of earth and rock were excavated to make way for the subway.

Three sections required deep tunneling—along Park Avenue from 34th Street to 42nd Street; under the northwest corner of Central Park; and from 157th Street to Fort George in Washington Heights. The tunnel under the Harlem River was built with an early version of the immersed tube method. The Manhattan Valley viaduct included a renowned trussed arch bridge still standing today at 125th Street.

Most stations were accessible by stairs, which accommodated larger crowds than would have been possible with elevators or escalators. Glass-block ceilings and grates provided natural light. Electric power was supplied from a remote generating station—a huge powerhouse on the city's west side—and conveyed to the trains via a third rail (co-invented by Parsons's eventual partner, Henry Brinckerhoff).

The stairways and "blowholes" in the roof ventilated the subway. Although the air quality was docu-

Workers at 149th Street and Courtlandt Avenue in the Bronx, September 1902.



The powerhouse for the subway system was located on Manhattan's west side.

mented as satisfactory, excessive heat and insufficient ventilation were complaints—Parsons had used six layers of waterproofing to control water inflow. In 1905, work began on adding ventilation chambers, sidewalk gratings, mechanical fans, automatic louvers, and an experimental cooling plant at the Brooklyn Bridge station to improve ventilation.

The Rapid Transit Construction Company, controlled by financier August Belmont, built the subway under a concession granted by the city. John B. McDonald was the contractor, and 10,000 to 12,000 men were employed to build the 20.5-mile system at a cost estimated by newspapers of the day at $50 million to $65 million, including equipment.

As chief engineer of the city's Rapid Transit Commission, Parsons had "sweeping powers of supervision" during the construction, according to an account produced by Belmont's Interborough Rapid Transit (IRT) Company. The IRT subway line was an early and outstanding example of a public–private partnership for producing public infrastructure through a design–build–operate–maintain arrangement.

Opening Day

The initial leg of the system, from City Hall to 145th Street, a distance of 9.1 miles, opened to the public just four-and-a-half years after construction began in 1900. The opening ceremony, October 27, 1904, was a lavish public spectacle. Mayor George McClellan took the controls of the first train to leave City Hall and piloted it—somewhat haphazardly, according to accounts—to 103rd Street; an official motorman then drove the train to 145th Street. The inaugural ride, at an estimated 25 miles per hour, took about 26 minutes, reaching 96th Street—the traditional boundary of Harlem—in 17 minutes, more or less justifying the slogan, "From City Hall to Harlem in 15 minutes."

An estimated 150,000 New Yorkers rode the subway on opening day. Newspaper reports varied.

"There was lots of noise of the hilarious, buoyant sort, a great deal of celebrating of the inoffensive kind, no end of joking and holiday spirit," according to *The World*. The *New York Daily Tribune,* however, reported "indescribable scenes of crowding and confusion, never before paralleled in this city."

The public and the press greeted the new subway with almost universal acclaim. "The subway is a beauty," said Mayor McClellan. "It is greater than any of us dared dream."

The Sun declared, "This is the finest, handsomest, most complete and best equipped underground railway in the world."

City Hall Station was the starting point for the initial leg of the subway system.

Subway cars at 125th Street, 1904.

The New York Times called the subway "the greatest achievement of the time in municipal engineering" and noted that Parsons "had [proved] that great public works may be carried to completion with an unsullied reputation and clean hands."

The Globe wrote that the subway "will stand on the records as an enduring monument to [Parsons's] genius."

Digging out the Steinway Tunnel below the East River, to connect Manhattan and Queens by subway.

Parsons resigned from the Rapid Transit Commission shortly after the opening, although he collaborated again with August Belmont on the Steinway (Queensboro) Tunnel. The tunnel opened in 1907 and brought the subway to Queens under the East River.

Parsons also consulted on transit systems around the world. He was advisory engineer to the Royal Commission on London Traffic and was appointed a director of the London Tube in 1908. He chaired the Chicago Transit Commission, contributed designs for subways in Boston and Philadelphia, and served as a transportation adviser to San Francisco, Toronto, and Detroit.

The Subway After Parsons

Parsons foresaw that the subway system he designed would grow to meet the demands of the city's rapidly expanding population and the movement of people from downtown to the outer boroughs. The day after the opening, he said, "The railroad is not expected to be all that New York City should have, but…is hoped to be but a beginning of a comprehensive system such as future generations of New Yorkers and the inevitable growth of the city will require."

As Parsons predicted, the subway expanded during the early 20th century as rival concerns, including the Brooklyn–Manhattan Transit Corporation (BMT) and the city-owned Independent Subway System (IND), built lines that competed for passengers. In 1940, New York City took control of the three lines—the IRT, BMT, and IND—and consolidated them. New York City Transit, an agency of the Metropolitan Transportation Authority, now owns and operates the system, which includes 722 miles of rapid transit, with 26 lines and 468 stations in four boroughs, and which transports 7.7 million passengers each weekday.

Canals and Other Projects

After his resignation from the Rapid Transit Commission, Parsons was appointed to the Isthmian Canal Commission and the Board of Consulting Engineers to develop recommendations for the Panama Canal. President Theodore Roosevelt overruled the board's recommendation for a sea-level canal and opted instead for a canal with locks.

Parsons went on to design a sea-level route for the Cape Cod Canal in Massachusetts, a formidable project he undertook in partnership with Belmont. At the 1907 groundbreaking, Belmont likened previous attempts to build a canal to the experience with the subways: "The subways in New York went through the same [thing] for 20 years or more. Our engineer, William Barclay Parsons, is just as sanguine about this as he was about them, and so am I."

Nonetheless, Belmont and Parsons underestimated the difficulty of constructing the canal. When

it opened in 1914, the canal proved difficult to navigate and did not fulfill the intended goals. In 1928, the U.S. Army Corps of Engineers assumed control of the canal and made it commercially successful, by deepening, widening, and lengthening it, making it then the widest artificial waterway in the world.

On Engineering

In his writings, Parsons offered opinions on the role and the obligations of the engineer in society. He rejected the view that engineers are narrow technical specialists, and argued that engineers and engineering can influence social and economic development: "Of all human activities, engineering is the one that enters most into our lives, that gives us our means of living, and permeates every fiber of the social fabric."

He said that an engineer must have two abilities: "First, the technical skill; and second, the mind and the knowledge to conceive that which is useful and will be for the convenience of mankind in the long run….It is not the design that governs [a project] but its adaptability to the economics and social needs of the time." He argued that engineers must "have the imagination to conceive all solutions and the courage to innovate."

Parsons was also prescient in noting that the complexity of designing and building modern infrastructure would demand that engineers be well-rounded managers in addition to technicians. "The engineer of today, and more especially of the future, will...be concerned not only with his calculations but also will have to study men and their needs, questions of industrial demand, the law of finance, and much in regard to legislation. His it will be to conceive, to plan, to design, to execute, and then to manage."

Renaissance Man

Best known for his work on the New York City subway, Parsons also was a renowned military engineer, a prolific author, and a respected community leader in New York City.

When the United States entered World War I in 1917, Parsons was 58 years old, but he left his engineering practice to command the legendary Eleventh Engineers Regiment—the "fighting engineers"—of the First Army. The Eleventh Engineers built roads, railroads, bridges, and docks and also engaged in combat. In Cambrai, France, in 1917, some fought with picks and shovels before retrieving their weapons during a German attack.

For his service to the Allied cause, Parsons received many honors, including the Distinguished Service Order of Britain, the Office of the Legion of Honor of France, and the Order of the Crown of Belgium. In 1919 he was promoted to Brigadier General, although he preferred the title of Colonel, which is carved on his gravestone.

Parsons recounted the experience of the Eleventh Engineers in his book, *The American Engineers in France*. Profoundly moved by the devastation of the war, he dedicated the book to "the memory of all the American engineers who fell in France...as a small tribute of admiration and respect."

A prominent citizen of early 20th century New York, Parsons served as a member of the board of trustees of the New York Public Library from 1911 to 1932 and as a trustee of his alma mater, Columbia University, for 35 years, including terms as chairman from 1917 to 1932. He also chaired the administrative body of Columbia–Presbyterian Medical Center; he drove in the structure's final rivet on May 24, 1926. He was a vestryman and warden of New York's Trinity Church, a trustee of the Carnegie Institution, and a fellow of the National Academy of Arts and Sciences.

Parsons's interest in Mayan culture led to the discovery of significant archeological artifacts in the Yucatan Peninsula. He admired the engineer and inventor Robert Fulton and authored the book, *Robert Fulton and the Submarine*.

Parsons devoted the latter part of his life to researching and writing the 651-page *Engineers and Engineering in the Renaissance,* an exhaustive account of the major figures and their accomplishments. After doing research at the Vatican library, he proposed a cataloging system that was approved by Pope Pius XI and implemented with assistance from the Carnegie Institution.

Parsons died in 1932 at the age of 73, with outstanding accomplishments in engineering, letters, military service, and philanthropy. His friend, Nicholas Murray Butler, president of Columbia University, said that Parsons was "a true representative of the culture and refinement of old New York, and his interest in education, in religion, philanthropy, and in public service all came as naturally to him as did the ordinary incidents of life."

Parsons had explained his own accomplishments with characteristic modesty, pointing only to perseverance and hard work.

"I have failed utterly to discover any substitute for hard work," he wrote. "I have found nothing to take the place of midnight oil. I am at a loss to know how to succeed except by plugging."

Parsons commanded the "fighting engineers" of the First Army's Eleventh Engineers Regiment in World War I.

Resources

Bobrick, Benson. *Labyrinths of Iron: A History of the World's Subways*. Quill William Morrow, New York, 1981.

Bobrick, Benson. *Parsons Brinckerhoff: The First 100 Years*. Van Nostrand Reinhold Company, New York, 1985.

Interborough Rapid Transit Company, the New York Subway: Its Construction and Equipment. Arno Press, New York, 1904.

POINT OF VIEW

Developing Around Transit

Challenges for Cities and Suburbs

ROBERT T. DUNPHY

The Englewood City Center project, outside Denver, Colorado, includes city hall, offices, retail shops, and housing. The Denver Light Rail station is at the rear in the center.

The author is Senior Resident Fellow, Transportation and Infrastructure, Urban Land Institute, Washington, D.C., and a member of the TRB Transportation and Land Use Committee.

Current interest in public transit investments is enormous. The challenge is to create the supporting development that will make the investments work.

The Federal Transit Administration recently approved funding for projects in Phoenix, Arizona, and Charlotte, North Carolina. The two join the ranks of light rail cities, which in recent years have added Houston, Texas; Las Vegas, Nevada; and Minneapolis, Minnesota—regions in which transit had captured only 3 to 5 percent of commuters in 2000.

In spreading from traditional markets such as New York, Chicago, and San Francisco to nontraditional markets in the South, Midwest, and West, transit faces a twofold challenge. The first challenge is for advocates to convince the larger community that transit will work—that it will serve middle-class people who are accustomed to driving. The second and more difficult challenge is making the case that compact, urban development around transit will work to generate the ridership necessary to support the new project.

This kind of smart growth linked to transit is also necessary in established markets that have grown up around transit. Ironically, residents in some traditional transit cities such as Boston and Cleveland do not believe that they have any transit-oriented development, which is perceived as more of a West Coast, new urbanist phenomenon—that is, allied with smart growth and walkable communities that are large suburban planned developments.

Aspects of a Conundrum

The conundrum is that much of the interest in new transit investments is occurring in places where transit is a novelty, yet many established transit markets are struggling to maintain services. A national survey, conducted under the Transportation Research Board's Transit Cooperative Research Program, identified approximately 100 transit-oriented developments in the United States.[1] This is a paltry number, which suggests either that not much is occurring or that the size of this market is severely underrepresented in the survey results, considering the vast amount of attention devoted to the topic of transit-oriented development in the planning and transit literature.

A new book by the Urban Land Institute, *Developing Around Transit: Strategies and Solutions That Work,* avoids the term transit-oriented development but highlights examples that meet the goals, whether or not the developers or the cities acknowledge it (*1*).

Another aspect of the conundrum is that from a

[1] Transit Cooperative Research Program Project H-27, Transit-Oriented Development: State of the Practice and Future Benefits.

transit perspective, urban projects yield the greatest leverage in expanding transit ridership and supporting transit services. New housing and offices in neighborhoods with good transit service create additional transit riders, often without the need for adding transit service. Neighborhoods accessible to transit also give options to new residents who would like to avoid driving.

Reshaping Development

Building in established urban areas is friendly to transit, but unfriendly to development. Projects take longer and are more expensive to build. The market is often unproven—the risks are high, and profits are uncertain. In contrast, conventional suburban projects are development-friendly, but transit-unfriendly. Most growth is expected in the suburbs; therefore the challenge is to reshape conventional development to create the kind of vibrant places that offer transit choices.

The market opportunities for urban infill development are excellent in many older areas, with young professionals and empty nesters seeking a more urban lifestyle, and with employers seeking neighborhoods that offer more employee amenities. In the report, *Emerging Trends in Real Estate: 2005*, the Urban Land Institute and PricewaterhouseCoopers ranked the areas near transit highest for development and investment, reflecting the appeal of infill development, as well as the public's frustration with traffic congestion.

Development, however, does not occur just because of transit. Block 37 in downtown Chicago, for example, has been vacant since 1990, when the city cleared the land for mixed-use development. The location is excellent, but the vagaries of the marketplace have foiled the city's plans to create a mixed-use development in one phase—the office market lacked sufficient depth when retail business was strong, and vice versa. When the city relaxed the requirement for single-phase development, a new developer with a retail orientation gave the project new momentum. The experience demonstrates that in urban infill development, a strong location cannot make up for soft market conditions or unrealistic expectations.

Block 37 in downtown Chicago was hard to develop despite the ready benefits of transit access in the Loop.

The Mockingbird Station residential development stands adjacent to Dallas Area Rapid Transit's Mockingbird Lane Station.

The first mixed-use transit project in Texas, Mockingbird Station is located adjacent to a Dallas Area Rapid Transit light rail station. The developer understood the appeal of in-town living near transit, although the city would not assist with pedestrian improvements and would not relax parking standards because of the light rail. In contrast, Dallas suburbs such as Richardson and Plano have created more urban development around their transit stations.

Markets and Policies

Reinforcing a strong market with consistent public policies can turn individual projects into successful transit districts. One of the best examples in the United States is the Rosslyn–Ballston corridor in Arlington, Virginia. The vision that developed three decades ago with the support of public officials and civic leaders has turned a once-declining strip into a vibrant mix of office, high-density residential, retail, dining, and entertainment. The development is a massive fiscal success, giving Arlington County the region's lowest tax rate.

Successful development around transit is a challenge for cities and suburbs. The transit project must be attuned to the needs of the real estate development market, and developers in turn must appreciate the special opportunities of transit.

Reference

1. Dunphy, R., R. Cervero, F. Dock, M. McAvey, and D. Porter. *Developing Around Transit: Strategies and Solutions That Work*. Urban Land Institute, Washington, D.C., 2005.

POINT OF VIEW presents opinions of contributing authors on transportation issues. The views expressed are not necessarily those of TRB or TR News. *Readers are encouraged to comment in a letter to the editor on the issues and opinions presented.*

Reports from the Transportation Research Board's
2005 FIELD VISIT PROGRAM

LABORATORIES FOR ADDRESSING CRITICAL ISSUES

State Departments of Transportation Test Out Solutions





Specialists in the Transportation Research Board's Technical Activities Division identify current issues, collect and generate information on the issues, and disseminate the information throughout the transportation community. The TRB Annual Meeting, TRB-sponsored conferences and workshops, standing committee meetings and communications, publications, and contact with thousands of organizations and individuals provide TRB staff with information from the public and private sectors on all modes of transportation.

A major source of this information is the TRB annual field visit program. TRB staff meet on-site with representatives of each state's department of transportation and also with representatives of universities, transit and other modal agencies, and industry.

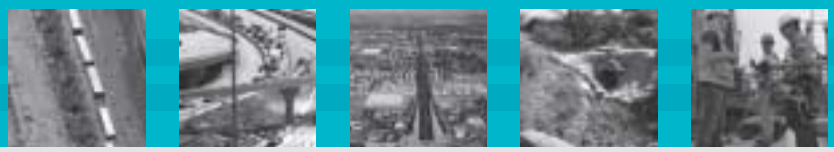
This report presents a summary of what the TRB staff learned from these visits and activities over the past year.

State departments of transportation (DOTs) and other transportation organizations are dealing directly with the challenges identified in TRB's recently released edition of *Critical Issues in Transportation*. These critical issues include

- Congestion: increasingly congested facilities across all modes;
- Emergencies: vulnerability to terrorist strikes and natural disasters;
- Energy and environment: extraordinary challenges;
- Equity: burdens on the disadvantaged;
- Finance: inadequate revenues;
- Human and intellectual capital: inadequate investment in innovation;
- Infrastructure: enormous, aging capital stock to maintain;
- Institutions: 20th century institutions mismatched to 21st century missions; and
- Safety: lost leadership in road safety.

More details on these critical issues are available in the special insert in this issue of *TR News* and on the TRB website.[1] The 2005 field visits yielded many examples of how transportation organizations view these critical issues, including perspectives from a variety of disciplines and modes. The field visits found that state DOTs and other organizations already are at work to address these issues.

[1] www.TRB.org/publications/general/CriticalIssues06.pdf



Institutional Issues

Policy and Organization

The graying of America has affected the transportation sector. State DOTs are grappling with the problem of workforce succession.

By 2020, 25 percent of all Americans will be age 65 or older. Providing transportation services for those who are no longer able to drive will require advance planning and significant funding. Moreover, the wave of retirements by baby boomers has created the need to recruit, educate, train, and retain qualified transportation professionals as successors.

In the past three years, an estimated 1,400 Pennsylvania DOT employees have retired—10 percent of the department's staff. Other state transportation agencies across the nation face similar challenges, with large numbers of staff expected to retire in the next 10 years.

Training suitable replacements for senior staff has begun. Pennsylvania DOT's Lead Program, for example, recruits, trains, and provides opportunities for female transportation professionals. South Carolina is developing a Resident Engineering Academy to offer training modules in seven subject areas: intelligent transportation systems; construction management; administration; environment; materials; hydrology and draining; and project management. Also offered are online training tools for maintenance workers.

In addition to educating and training staff for succession to senior-level management, DOTs are seeking ways to capture the institutional memory and knowledge of veteran employees to pass along to the next generation of leaders. In 2006, TRB is planning a forum for state DOT CEOs to address this and other issues.

New York State DOT is completely reorganizing under a process called "the transformation." The emphasis is on the DOT's role as an operator instead of as a builder of the transportation system. In addition, the transformation takes into account the continually shrinking workforce—the number of full-time employees has dropped from 13,000 to 9,000 in the past 10 years.

Pennsylvania DOT's Lead Program has had success in creating a leadership path for women on staff. Participation in the program facilitated the promotions of Jill Reeder (*left*), a management analyst supervisor, and Erin Sodan (*right*), a human resource analyst in labor relations, shown with the mentoring program's project manager, Elizabeth Threnhauser (*center*).

IOWA STATE UNIVERSITY

Civil engineering students gain first-hand instruction at a highway reconstruction site in Iowa.

Legal Issues

Transportation lawyers have ongoing concerns about agreements for the design and construction of projects. Transportation agencies are relying increasingly on design–build and on public–private development strategies, whether to complete projects quickly or to gain the funding to make a project feasible.

Design–build legislation is in effect or is pending in 28 states. The laws are diverse, and many questions are unanswered, creating many issues to be addressed by the resolution mechanism for contract disputes.

Another pressing issue is contracting with disadvantaged business enterprises. In *Western State Paving, Inc. v. Washington State Department of Transportation et al.*, the United States Court of Appeals for the Ninth Circuit upheld the constitutionality of the disadvantaged business provisions of the Transportation Equity Act for the 21st Century (TEA-21). The prevailing policy in several federal judicial circuits is that Congress must make a finding of discrimination to support the need for a disadvantaged business program as a component of the Congressional program, or a state or local government must collect data and make its own finding of need. The disadvantaged business program must be tailored to the need of the jurisdiction in which it is established.

Did You Know?

In Florida, 18 percent of the population is 65 and older. By 2020, 25 percent of the population will be 65 or older, and of these, almost one-half will be 75 or older. More than 80 percent of trips made by those 65 and older are made in cars.

◆

State law mandates that the Idaho Transportation Department maintain a staff of 1,833. As staffers retire, the department must have suitable replacements available.

◆

In 2005, Missouri DOT started MoDOT Tracker, a comprehensive management performance measurement program (www.modot.gov/about/general_info/Tracker.htm) "to assess how well we deliver services and products to our customers."

JAMIE L. FOX, JACOBS CIVIL, INC.

Design-build arrangements, which produce projects like the Peace River Bridge in Florida, are subjects of diverse legislative proposals around the states.

In the Western State Paving case, the court ruled that that the State of Washington was justified in relying on the Congressional finding; however, the state had not collected data to determine the extent of discriminatory treatment of minorities within its jurisdiction and therefore could not have tailored a program to remedy the problem. The decision highlights the differences between federal circuit courts on whether states can rely on Congressional evidence of discrimination or must establish their own.

The security of our nation's transportation system also raises legal issues. Despite heightened security measures, officials must conduct the routine business of constructing, maintaining, and operating transportation systems. Agencies are concerned about preserving the confidentiality of security-sensitive plans and specifications for public works and transportation projects. Many believe that the legal processes are not sufficient to protect the information.

Contracting team with Washington State DOT's Disadvantaged Minority and Women's Business Enterprise Program work on the new Tacoma Narrows Bridge.

ZOE ESTRUS, WSDOT

Planning

Transportation planners are becoming more creative in communicating with stakeholders. Techniques span a variety of media and include website postings, face-to-face meetings, and printed reports. Planners and other transportation professionals rely on these techniques to present technical information to different and diverse audiences, including the general public, staff within the agency and at other agencies, and decision makers.

Communication with the public ranges from explanations of how tax dollars are being spent to briefings on specific transportation issues, such as bicycle safety. Virginia DOT and Washington State DOT have developed popular web pages and periodic status reports to inform the public. Virginia's "Dashboard" provides a graphic performance report on the department's projects and programs.[2] Washington State DOT's Accountability web page details the department's progress on issues of interest to the public, including congestion and construction schedules.[3]

Residents who completed the Frederick 101 course gather for a reception with Mayor Jennifer P. Dougherty (*center*).

Frederick City, Maryland, offers "Frederick 101," a six-week seminar for city residents. City department heads lead the seminar, which gives residents an opportunity to learn how the city is governed and to meet the officials who keep the city operating.

Brown bag lunches and training courses for staff and consultants are other important communication tools. New goals and procedures increase the need for communication within agencies. For example, context-sensitive design programs and the new stormwater management requirements necessitate communication among DOT staff in all offices and with contractors.

Resource agencies, other transportation agencies—such as metropolitan planning organizations (MPOs) and transit providers—and local agencies have become partners in providing transportation. The partnerships are critical to achieving the state DOT mission, and communication is critical in forging strong partnerships. The communication can be formal, as with a signed memorandum of understanding, or informal—for example, with regular lunch meetings.

[2] http://dashboard.virginiadot.org/default.aspx
[3] www.wsdot.wa.gov/accountability/default.htm.

LOUIS A. BARKER

New Hampshire DOT promoted bicycling and bicycle safety in conjunction with the state fair.

Energy and Environment

Transportation agencies are striving to become better stewards of the environment. Approaches to air quality, wildlife crossings, stormwater control, and other environmental issues are changing with new research and practical experience.

Noise is one of the most pervasive environmental impacts. To control transportation noise, the profession has embraced a "three-pronged approach" that involves (*a*) control of the source, (*b*) land use planning and control, and (*c*) mitigation at the receiving point—or path control.

Quiet pavements—asphalt rubberized with recycled tires—are among the promising techniques for controlling highway noise at the source and are being tested across the country. Arizona DOT, for example, has a Quiet Pavement Pilot Program under way in Maricopa County for resurfacing 115 miles of freeway. Early tests show a reduction in noise levels of about 4 decibels or more.

In addition to the benefits of noise reduction, the program will recycle 1,500 tires for every lane-mile constructed. Research on the project will examine the long-term noise reduction effectiveness, the maintenance requirements, and the durability of the rubberized pavement.

"Heat islands"—urban air and surface temperatures that are higher than surrounding rural areas—and their effects on urban residents and vegetation are an emerging environmental issue. Heat islands form when cities replace natural land cover with pavement, buildings, and other infrastructure; the temperatures can reach up to 10°F (5.6°C) warmer than the surrounding natural land cover.

Cities experience higher rates of heat-related illness and death than rural areas do. The heat island effect can contribute to raising summertime temperatures to levels that pose a threat to public health. Under certain conditions, excessive heat also can increase the rate of ground-level ozone formation—that is, smog—presenting an additional threat to health and ecosystems within and downwind of cities.

Communities can take several steps to decrease the impacts of heat islands. Heat island reduction strategies include

- Installing cool or vegetated green roofs;
- Planting trees and vegetation; and
- Switching to cool paving materials.

The U.S. Environmental Protection Agency's Heat Island Reduction Initiative (HIRI) supports research programs to develop heat island reduction strategies for U.S. cities. HIRI-supported research aims to improve understanding of the impacts that heat island reduction strategies have on urban meteorology, air quality, energy demand, and human health.[4]

Data and Information Technologies

Statewide data programs are realigning to reflect department priorities and to demonstrate the value of data for the delivery of programs. Initiatives such as transportation system performance measurement and asset management accentuate the need for data sharing and integration.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-

[4] www.epa.gov/heatisland/index.html.

Did You Know?

With fire dangers from dry, overgrown brush along roads, California DOT (Caltrans) is getting its goats. In a pilot program, Caltrans sent a herd of 600 goats to munch on the dry brush along Interstate 880 and Highway 238 in San Leandro. The goats were able to manage the rocky terrain without generating the noise and fumes of mowers and weed trimmers.

◆

When Arizona DOT improved roads in the Organ Pipe Cactus National Monument, the construction plan required salvaging and storing the top 6 to 8 inches of excavated soil during construction. The soil and seed collected in the park were used to revegetate disturbed areas.


KIM FISHER


KIM FISHER

(*Far left:*) Pioneer road built within the footprint of the new US-60 near Phoenix, Arizona, to provide access to geotechnical and archaeological sites and testing. (*Left:*) Stormwater management treatments installed before roadway construction.

NATIONAL CENTER OF EXCELLENCE ON SMART MATERIALS

Interstate 17 in Phoenix, Arizona, is paved with asphalt rubber, which reduces levels of tire–pavement noise, as well as pavement-generated heat.

(*Top left:*) Special vehicle for thermal readings of surface and ambient temperatures. (*Bottom left:*) Thermal sensors placed into a conventional portland cement concrete blend. (*Right:*) Handheld infrared thermography of cool pavement designs under testing at the National Center of Excellence on SMART Materials, Arizona State University.

LU) includes requirements for relating data from several programs and organizations, especially for safety analysis; this has heightened interest in integrating data. The revised pavement design guide of the American Association of State Highway and Transportation Officials (AASHTO) also is prompting the reevaluation of traffic data programs to ensure the availability of relevant data.

Many DOTs are taking a more systematic approach to the capture, archiving, and analysis of intelligent transportation systems data to improve understanding of traffic flows and to make extrapolations. Recent disasters have confirmed the need for good inventories of physical assets and for strong analysis tools like geographic information systems (GIS) for evaluating a disaster's impact and planning the response.

The state data community is concerned about the continuation of key national data sources—the National Household Travel Survey (NHTS), the Commodity Flow Survey (CFS), and the decennial census.

JAY GOLDEN AND KAMIL KALOUSH

Funding for the NHTS and CFS is uncertain under SAFETEA-LU.

The transportation planning community is cautiously optimistic about the transition from the decennial census to the American Community Survey (ACS) for journey-to-work data. The ACS offers the potential for annual population updates for large areas and for improvements in the tracking of trends.

But the federal commitment to adequate annual funding for the ACS is also a concern. Although much data collection is oriented to traditional travel demand forecasting, new requests for data to evaluate policy alternatives are leading many agencies to reexamine their models and their supporting data programs.

Obtaining and using freight transportation data are substantial challenges for state DOTs, MPOs, and metropolitan areas. Uses of freight data are varied and complex. Two national data sets became available in the past year—the Commodity Flow Survey (CFS) and the Vehicle Inventory and Use Survey.

The CFS provides multimodal freight activity patterns every five years. Some agencies will purchase private-sector freight data from companies, although the geographic detail often is not sufficient for ready application to traffic and planning models. Some mode-specific data sources—such as maritime and railroad freight data—provide adequate detail for intermodal planning, but data for trucking, which is the largest mode of freight transportation, are least available.

State DOTs are increasing the use of GIS, often with agencywide units that manage departmentwide applications. Most state DOTs are moving to an enterprise organizational structure, and staffs formerly oriented to mapping are evolving to provide technical support.

Aviation

State aviation officials are concerned about the state of the airline industry and its future, as well as the challenges of funding the national aviation system, with state and federal budgets shrinking and regulatory requirements increasing in complexity.

Airlines are facing financial crises, and the aviation system infrastructure is straining under levels of traffic that are reaching historic highs. The business and general aviation communities also are reaching record levels of traffic. As the new "very light jets" begin to enter the market in 2006, this segment of the industry is primed for major changes.

The federal government is reviewing ways to fund the infrastructure needs of the national aviation system. Fuel taxes, user fees, and other charges now in place are not sufficient to cover future needs, and their equitability for users of the system is a subject of debate.

(Eclipse Aviation)

New very light jets, entering the market in 2006, will introduce major changes in business and general aviation.

Many airports are under financial strain trying to accommodate fluctuating levels and types of operations under increasing regulatory controls. Environmental regulations present challenges to airports and users, particularly the Environmental Protection Agency's Spill Prevention, Control, and Countermeasure requirements and the guidelines on effluent limits. Some state aviation agencies continue to support Airport Land Use Compatibility programs to reduce urban encroachment on already constrained airport systems.

Freight Systems

General Freight Issues

Freight system capacity issues have made headlines in recent years, so that the general public is more aware of the impacts of growing freight volumes, and public agencies at all levels are pressured to play a role in relieving freight bottlenecks. Much of the growth stems from international trade, particularly from China, which puts pressure on West Coast ports and then on the highway and rail system connections as the goods flow across the country.

As highway infrastructure providers, states must partner with private-sector carriers and shippers to provide adequate system capacity. Critical needs at the state level include management and staff capabilities to deal with freight issues; institutional capabilities to deal with the private sector and with other public agencies; and funding for improvements in freight flow.

AASHTO is identifying a key freight official in each state DOT who understands what the freight job is and who knows the parties that perform it. The Federal Highway Administration (FHWA) is providing freight training for state DOT staff, and AASHTO is focusing on freight education at the executive level.

The flows among ports, major intermodal, rail, and trucking hubs, and major market areas define freight corridors. SAFETEA-LU reauthorization did not provide the expected support for a corridor approach to improving freight flows. In general, funding for freight improvements, particularly from a combination of public and private sources, remains a major concern as international and domestic freight volumes increase.

Trucking

Trucks provide vital links in the freight transportation system, including the critical "last mile" in many deliveries and pickups. Increases in truck traffic are the result of growth in domestic and international freight. International freight flows translate into congestion on the highways that provide port access—for example, the highways that serve the ports of Los Angeles and Long Beach.

Marine terminals in Los Angeles and Long Beach have collaborated to launch the PierPass program, which imposes a peak-hours fee. The program has shifted almost one-third of port-related truck traffic to off-peak hours.

Concerned that fuel taxes will not raise adequate funds for rebuilding and expanding highway capacity, many states are considering tolls or congestion pricing to improve the use of capacity. The impacts of tolling and congestion pricing on the trucking industry are subjects of debates and studies.

A Georgia study surveyed various groups of stakeholders to determine the value point at which truckers would use a toll road. The study concluded that truck-only lanes could produce up to 20 percent more relief than would high-occupancy toll or high-occupancy vehicle lanes.

These issues also illustrate the need for mutual education and dialogue between the trucking industry and public agencies. Planning activities in many states have focused on identifying major truck routes, measuring truck traffic, and forecasting truck flows. The need for truck flow data at the state and local levels and for appropriate modeling tools is critical.

Freight volumes—and bottlenecks—are increasing nationwide.

Reports from the Transportation Research Board's

2005 FIELD VISIT PROGRAM

Did You Know?

Massachusetts Department of Public Works is scanning old mylar design drawings and converting them to an electronic graphic format for archiving.

◆

Nevada DOT has conducted research on the viability of tilted signs. The signs are installed at an angle to avoid snow sticking to the surface.

◆

Construction of the new Woodrow Wilson Bridge, spanning the Potomac River between Virginia and Maryland at the southernmost tip of Washington, D.C., will use more than 140 million pounds of steel, more than the total weight of all the new cars sold each year in Virginia and Maryland.

Highways

Design

An aging infrastructure and a heightened public awareness of the importance of a reliable and safe transportation system are creating a demand for the redesign of roadways, the rehabilitation of pavements and bridges, and a reliance on innovative materials and techniques to get the job done more efficiently.

States are depending on contractors for the design and inspection of infrastructure projects. Contractors often must perform quality control, with quality assurance by inspection service providers. Several states are researching automated inspection, data collection, and reports to compensate for a reduced in-house inspection work force.

States that are developing implementation plans for the recently piloted AASHTO pavement design guide are conducting related calibration and training efforts. Many states are looking for additional information from the National Cooperative Highway Research Program (NCHRP) to assist in training.

Use of the load and resistance factor design method for bridges and other structures has increased as the 2007 implementation deadline approaches. The level of adoption among the states varies from full to none. Many states are working on substructure calibrations.

States are using innovative materials such as high-performance concrete and structural fiber-reinforced plastics and are relying on innovative design and construction techniques such as precast pavement and bridge members to build structures more efficiently and more durably. The goal is to reduce work zone construction and maintenance activities in travel lanes.

The draw spans, or bascules, of the new Woodrow Wilson Bridge, near Washington, D.C., feature eight opening leaves composed of more than 14 million pounds of steel.

ACTT Workshop team develops a cost-efficient construction strategy.

Highway Construction

Infrastructure renewal, congestion relief, and safety improvements are the goals for most state DOT construction projects. Contracting options and public information campaigns are among the strategies to minimize the inconveniences of roadway construction to motorists and the disruptions to adjacent property owners.

Construction in the midst of traffic requires planning for the safety of the motorists and of the project personnel. Utility work is the major source of delay on projects. Many states are concerned about construction quality because of a diminished and untrained work force.

States are improving their environmental stewardship in construction. At least one state has implemented an environmental management system, and others have added environmental positions in their construction divisions.

More than one-half of the states have applied the project development procedures from the Accelerated Construction Technology Transfer (ACTT) workshop conducted by FHWA and AASHTO. FHWA estimates that ACTT—conceived by the TRB Task Force on Accelerating Innovation in the Highway Industry—may be saving state DOTs millions of dollars and many years of construction time.

Highway Materials

Improved performance, durability, and environmental considerations are the watchwords for materials. Most states are investigating self-consolidating concrete for structural members. Recycled and waste materials and byproducts are acceptable for use in most states as long as specifications are met and costs are competitive.

Several states have worked with industry on warm-mix asphalt demonstration projects. The technology offers the advantage of laying asphalt pavement at lower mix temperatures, reducing

odors and emissions.

Construction and materials issues throughout the states include quiet pavements, moisture sensitivity and segregation of asphalt pavements, and the constructability and durability of concrete mixes.

Geotechnical Engineering

Ohio DOT has taken the lead in developing a geotechnical management system (GMS) in a pooled fund study with 10 other state DOTs, several U.S. federal agencies, and the United Kingdom Highway Agency. Every state DOT has archived vast amounts of geotechnical engineering information and gathers and adds new information each year, which makes the development of data management systems essential. Yet without standardization of the database, the systems may become unwieldy.

The pooled fund study will develop frameworks, standards, and protocols to accelerate development of the GMS. Collaboration and information sharing should minimize redundancy. The project is scheduled for completion in mid-2007.

State DOT experience with the use of geophysics for transportation projects is varied, but general interest has increased. An NCHRP synthesis report on the topic—slated for publication this year—will assemble useful information for practitioners on geophysical methods, applicability, and limitations.

Many states are outsourcing some geotechnical exploration. The percentage of the work that is outsourced varies from state to state.

The effects on aquatic life from the vibrations related to pile driving has emerged as an environmental problem. California, Washington, and Oregon are conducting a study of ways to eliminate or minimize the adverse effects.

Highway Maintenance

In line with asset management, a preservation approach is being developed to improve the level of service and to extend the service life of transportation infrastructure. Successful transition from a reactionary to a preservation approach depends on the commitment and support of the agency's top management and of the political oversight body; a repeatable measurement system that can appraise conditions and monitor progress toward achievable goals; flexibility in the selection of the preservation actions appropriate to the project conditions; and champions working throughout the agency to keep the programs on track.

Many DOTs are developing and implementing integrated management systems, employing advanced technologies to develop infrastructure inventories, monitor roadway element conditions, and forecast workloads within the context of asset management and environmental stewardship. The new performance-based maintenance management systems retain planning, budgeting, and resource management functions but have added roadway feature inventory and condition assessment, customer input, workload planning and forecasting, statistical sampling of roadway conditions using maintenance quality assurance, customer-driven benchmarking, and performance measures.

ROB THOMPSON, SOUTH CAROLINA DOT

South Carolina DOT maintenance employees attend a classroom training exercise to improve skills; some training is offered online.

Integrating these management systems requires common data definitions, several types of location reference systems, and commitments from upper management to support the costs. With decreases in employees, agencies are entering into public–private partnerships under a variety of procurement approaches, from short-duration contracts for labor, equipment, and materials to longer-term, lump-sum contracts for a corridor or a network, with stated outcome measures.

Safety for the traveling public, contractors, and agency workforces remains a priority. Many DOTs are deploying new technologies to provide real-time infor-

DAKTRONICS VANGUARD

Timely, informative signage systems contribute to highway safety.

Did You Know?

Ohio has 37 safe community programs. Each program examines highway crash trends, has access to crash data, and analyzes the data to develop safety programs.

mation to drivers approaching and moving through work zones and to the general public in rest areas and via the Internet for trip planning. Speeding and aggressive driving continue to counter efforts to make construction and maintenance work areas safer.

Succession planning for skilled maintenance employees is a critical need. The recruitment and training of employees is affected by the increases in contracting, outsourcing, and privatization; the technological complexity of maintenance and operations equipment; the changing mix of cultural characteristics, such as nationality, heritage, language, and generations; and an emphasis on security. Security requirements are evolving but can affect the scope of work and the ability to respond to manmade or natural disasters.

Highway Operations

Traffic operations professionals are concentrating on the management and operation (M&O) of the road system to improve the reliability of travel times by addressing the causes of congestion. According to FHWA, these causes include insufficient road capacity (40 percent); ineffective management of capacity, for example through poor signal timing (5 percent); work zones (10 percent); incidents (25 percent); weather events (15 percent); and special events or other causes (5 percent). FHWA estimates that improving M&O can increase regional systemwide capacity by 10 to 20 percent.

Recent M&O strategies include the following:

- Maryland DOT has developed an incident management program, the Coordinated Highway Action Response Team (CHART). Initially a strategy to improve travel times to and from the state's beaches, CHART has evolved into a statewide operations tool that collects, processes, and broadcasts traffic information to motorists.
- Wisconsin, Illinois, Michigan, Minnesota, Washington, Texas, and other DOTs have implemented freeway management and incident management systems. The systems include freeway management centers, vehicle detection equipment, dynamic message signs, ramp meters, freeway service patrols, and central computer systems. By combining innovative technology, policies, and allocation of resources, the DOTs are providing travelers with more reliable travel times on freeways that are more efficiently managed and safer.
- The Road Commission of Oakland County has implemented advanced traffic signal coordination, known as FAST-TRAC (for Faster and Safer Travel through Traffic Routing and Advanced Controls). The key component is an advanced adaptive traffic signal system that dynamically adjusts signal timing to vehicle demand at individual intersections or corridors.
- Texas DOT is adding a four-lane toll road in the middle of the Katy Freeway in Houston. Innovative construction and financing techniques will complete what was originally a 12-year construction project in 6 years. The toll road will incorporate value pricing, with travel lanes for high-occupancy vehicles with three or more passengers and tolls for other vehicles.

Construction of a four-lane toll road in the middle of Katy Freeway is part of Texas DOT's management and operation strategy. Photo shows the demolition of the former I-10 inner connector.

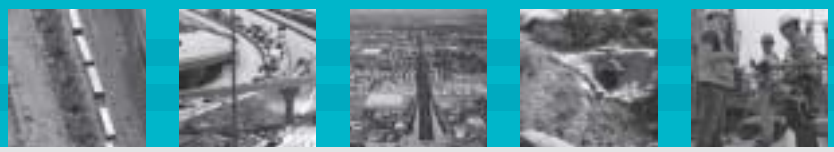
Highway Safety

Traffic safety statistics have yielded a combination of positive and negative news. Traffic deaths decreased slightly, from 42,884 in 2003 to 42,636 in 2004. With an increase in vehicle miles traveled, the fatality rate was 1.46 per hundred million vehicle miles, down from 1.48 in 2003.

Motorcycle fatalities rose again in 2004, from 3,661 to 4,008. Pedicycle-related fatalities increased from 629 to 725, and pedestrian fatalities declined from 4,749 to 4,641. Injuries from traffic crashes declined again: 2,788,000 compared with 2,884,000 in 2003.

Implementation of the AASHTO Strategic Highway Safety Plan continues; 16 of the 23 guidebooks have been published as NCHRP Report 500, and the series will be complete in 2006. Developed to complement the guidebooks, NCHRP Report 501, *Integrated Safety Management Process*, presents an approach for identifying safety problems within a state and for coordinating the various agencies and organizations that address the issues.[5]

[5] www.TRB.org/publications/nchrp/nchrp_rpt_501.pdf



SAFETEA-LU legislation has mandated that each state develop a strategic highway safety plan (SHSP). Many states started the process more than one year ago. In fall 2005, staff from 48 states met in a peer exchange on successes and on ways to overcome barriers. Successful programs were committed to coordination within and across the agencies and organizations that have roles in highway safety; were comprehensive, giving consideration to engineering, education, enforcement, and emergency medical services; and were data-driven and goal-directed.

Safety-conscious planning (SCP), a requirement under TEA-21, continues to develop. By the end of 2005, 25 states had organized and conducted SCP forums, which bring together representatives of highway safety and transportation planning to learn about each other's activities, to discuss data and resources, and to create an action plan that includes safety in the long-range transportation planning process.

The interaction and coordination of SCP and the SHSP has been beneficial in several states. For example, as part of the SHSP process, Ohio State DOT and the Governor's Representative for Highway Safety are working to conduct SCP forums with each of the MPOs within the state.

Marine and Intermodal

In the Gulf region, ports are reeling from the devastation caused by the 2005 hurricanes, especially in Mississippi and Louisiana. Recovery and rebuilding at many of the ports require extensive efforts.

Just before the hurricane disaster, Louisiana had launched an aggressive approach to the growth and development of maritime commerce by creating the Governor's Maritime Advisory Task Force and the Louisiana Waterways Infrastructure and Development Fund. The goal was to expand trade by financing waterside infrastructure and development projects.

DAVID L. RYAN, REUTERS

Fishing boats are pressed along a pier in Port Arthur, Texas, in the aftermath of Hurricane Rita, September 24, 2005.

JUDITH ADAMS, ALABAMA STATE PORT AUTHORITY

Site for the construction of Choctaw Point Terminal, Mobile, Alabama.

New port terminal development is under way at several locations. The Alabama State Port Authority is moving forward on plans to build a container terminal at Choctaw Point, which would boost the container capacity at the Port of Mobile 14-fold; financing comes from state funds and private investments. The Virginia Port Authority is seeking state funding to build a new container terminal at Portsmouth's Craney Island.

Landside congestion and infrastructure are challenges for many ports. In Southern California, a public–private partnership will be needed to finance a $20-billion rail-and-highway access infrastructure for the Los Angeles–Long Beach port complex.

Short sea shipping has been promoted as a solution to landside congestion in the United States, and some operations are now successfully under way or are in development along the East and Gulf Coasts. Challenges to the wide use or availability of short sea shipping, however, include conditions of the Jones Act, U.S. manning requirements, financing, and the harbor maintenance tax.

The inland waterways sector awaits approval and funding for major infrastructure improvements, with debate continuing over commodity forecasts and market demand. The 2005 hurricanes also affected inland waterway operations, as many barges were lost or damaged. On the Great Lakes, environmental issues are a primary concern, particularly preventing the introduction of nonindigenous invasive species.

The ferry sector is devoting considerable attention to new and proposed services, and to security, safety, and the environment. Liquefied natural gas terminals

Did You Know?

North Carolina DOT owns and operates a shipyard.

◆

A recent study reported that Georgia's deepwater ports and inland barge terminals support more than 275,000 jobs and contribute nearly $11 billion in income, $35 billion in revenue, and $1.4 billion in state and local taxes to the state's economy.

◆

The Port of Portland, Oregon, has a research branch to support air, rail, and maritime activities.

ROBERT MOORE, CONNECTICUT DOT

Connecticut DOT continues to invest in expansion and modernization of the heavily used New Haven rail terminal.

and transport have raised concerns in most areas of the country. In the Gulf region, a major focus is the impact of offshore terminals on fish populations.

Rail

Many states regard intercity and commuter rail passenger services as important elements of the transportation network, relieving demand on the more congested modes. Approximately one-quarter of the states provide financial support for Amtrak passenger services. The debate over federal funding for Amtrak is perennial.

Many states are investing their own funds or supplementing federal funds to improve rail passenger services. For example, Connecticut plans to spend more than $600 million on new self-propelled rail cars for the New Haven line and $300 million for new rail-maintenance facilities, as part of a major initiative to prevent roadway congestion in the southwestern corner of the state.

Commuter rail is coming to Utah as part of a congestion relief solution that includes highway improvements in the rapidly growing Salt Lake City area. With a combination of federal and local sales tax funds, the Utah Transit Authority is buying a portion of right-of-way from the Union Pacific Railroad to accommodate the commuter rail services.

The demand for rail freight services is straining rail capacity nationwide and has limited the ability of freight railroads to share facilities with passenger services in many areas. Choke points have developed where freight railroads receive large volumes of cargo—for example, at West Coast ports.

System velocity, capacity, and service reliability remain problematic despite many operational improvements. After more than two decades of shrinking, the rail system infrastructure, equipment supplies, and work force—as well as operations—must build up again to meet growing demand.

Public Transportation

For public transportation, 2005 was the best of years financially in terms of federal investments.

Valley Metro light rail will link Phoenix, Tempe, Mesa, and Glendale, Arizona.

DENIZ DURMUS, LOS ANGELES COUNTY MTA

Interior of an Orange Line bus rapid transit vehicle, serving Los Angeles and San Fernando Valley.

SAFETEA-LU reauthorization guaranteed $52.6 billion in funding for transit through FY 2009, which included 31 full-funding grants, 38 final design and construction projects, and 264 preliminary engineering projects. In addition, in the November elections, voters in New York, Washington, Texas, and Colorado approved ballot measures totaling more than $8.5 billion for public transportation projects. In all, 22 of 27 measures for public transportation investment gained approval throughout the country during 2005.

Light rail construction started in Phoenix, Tempe, and Mesa, Arizona. The Denver, Santa Clara Valley, and St. Louis systems added new lines. In Los Angeles, a bus rapid transit line—the Orange Line—opened in the San Fernando Valley, and the Tren Urbano began heavy rail service in San Juan, Puerto Rico.

December 1 marked the 50th anniversary of Rosa Parks's act of personal bravery, which opened equal bus service to all users. But not all the news was good:

◆ Hurricanes Katrina, Rita, and Wilma hit the Gulf Coast. Even with advance weather information and hurricane warnings, many were unable to or chose not to evacuate. Transit helped with the prestorm evacuations and with the recovery efforts, although most vehicles and facilities were destroyed or damaged. Of special note were many acts of personal valor and altruism. Using air mattresses, New Orleans transit staff helped to evacuate 150 people across more than 1 mile of floodwater. Emergency convoys of buses evacuated citizens stranded at the New Orleans Superdome and Convention Center; most of the 1,000 buses, emergency crews, and equipment came from out of state.

◆ The vulnerability of transit to terrorist attacks was exposed again on July 7. In London, England, three bomb blasts targeted trains and one ripped the top off a double-decker bus, killing 56 and injuring more than 700. A second attack was attempted on July 21.

Buses line up outside the convention center near New Orleans, Louisiana, to evacuate people affected by Hurricane Katrina, September 3, 2005.

DAVID J. PHILLIP, REUTERS

SIGNALS

The Dramatic Failure of U.S. Traffic Safety Policy

Engineering Is Important, Public Policy Is Crucial

LEONARD EVANS

The author, who was a research scientist at General Motors from 1967 to 2000, is a researcher, writer, and lecturer on traffic safety and president of Science Serving Society, Bloomfield Hills, Michigan. He is a member of the National Academy of Engineering.

The dramatic failure of U.S. traffic safety policy is one of our best-kept national secrets. Policies aimed at reducing the toll of 42,000 Americans killed each year rarely make the news. When they do, usually the institutions responsible for the policy failure are announcing that impressive progress is being made. To gain a realistic view, however, we need to compare our own progress with that of other countries.

My 2004 book, *Traffic Safety,* presents such a comparison (*1*). This article summarizes the main findings of that comparison and my interpretation of the findings. The book presents in detail the numerical calculations, the data sources, the references, and the documentation. The material in the book led to comments in a recent *TR News* editorial by Brian O'Neill (*2*). I am responding to those comments.

Until the mid-1960s, the United States had the safest traffic in the world, whether measured by deaths per registered vehicle or by deaths for the same distance of travel. By 2002, in terms of deaths per registered vehicle, the United States had dropped from 1st to 16th place. Australia, Austria, Canada, Denmark, Finland, Germany, Great Britain, Iceland, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, and Switzerland posted lower rates.

Comparing Fatalities, 1979–2002

The decline in U.S. safety relative to other countries can be explored by comparing changes in specific fatality rates with the changes in the same rates in other countries. Three traffic fatality rates are examined:

1. Fatalities per year—the raw fatality rate;
2. Fatalities per 1,000 registered vehicles—the vehicle rate; and
3. Fatalities per 100 million vehicle-miles of travel—the distance rate.

DAVID WOODS/CORBIS

U.S. traffic safety policy, the author notes, has focused on vehicle factors and on surviving crashes—for example, by mandating airbags, shown here deploying in a crash test—instead of preventing crashes.

Great Britain, Canada, and Australia are selected for comparison because they have much in common with the United States in terms of language, beliefs, and traditions. Performance is compared for the 23-year period from 1979 to 2002. In the late 1970s and early 1980s, the safety policies of the United States began to diverge from those of the three other countries. The results are not much different if the beginning and end of the period are a few years earlier or later, or if other countries are chosen for comparison.

Fatalities per Year

Figure 1 shows the change in the simplest measure of safety performance, the total number of traffic deaths per year. Fatalities in the 23-year period declined in the United States by 16.2 percent, but declines of 46.0, 49.9, and 51.1 percent occurred in Britain, Canada, and Australia. If U.S. fatalities had declined by the same percentage as in Britain, the total would have been 27,598 fatalities instead of the 42,815 reported. If the United States had matched the British rate of decline, 15,217 fewer Americans would have been killed in 2002. Matching the Canadian and the Australian performance would have reduced fatalities by 17,229 and 17,837.

Fatalities per Vehicle

Rates such as fatalities per 1,000 registered vehicles can be plotted without a reference year, as shown in Figure 2. Until the late 1970s, the comparison countries—like all other countries—had rates higher than those in the United States.

The U.S. rate shows no drop in response to the requirement that all 1968 and later models satisfy Federal Motor Vehicle Safety Standards. The only notable downward spike, in 1974, is unrelated to vehicles—it reflects behavior changes stimulated by the 1973 oil embargo, notably reductions in travel speed because of changes in speed limits.

The U.S. vehicle rate declined by 46.2 percent, but in Britain, Canada, and Australia the rates declined by 67.1, 63.5, and 71.9 percent. If the U.S. rate had declined by these same percentages, fatalities in 2002 would have been lower by 16,605, 13,718, or 20,429.

Fatalities by Same Travel Distance

The best estimates for distance of vehicle travel are for Great Britain, from observations at 50 sites by the Department of Transport. Reliable estimates for a long period are not available for most countries; therefore the travel distance comparison is limited to Great Britain. Figure 3 shows that the distance rate in Britain started out higher than the rate in the United States, but in 2002 the British rate was lower. If the United States had matched the British rate of decline, 15,670 fewer Americans would have been killed in 2002.

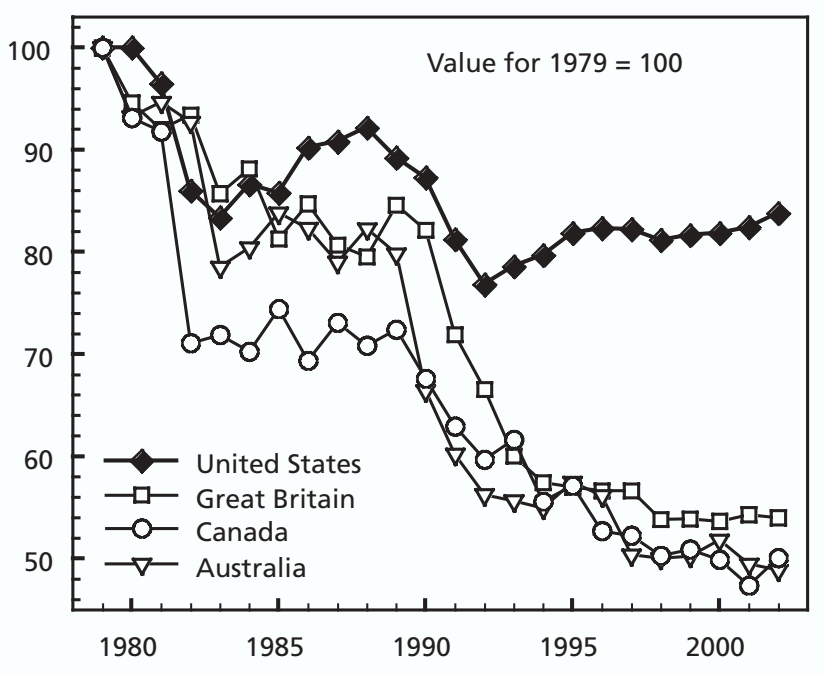


FIGURE 1 Traffic fatalities per year in the United States and in three comparison countries relative to the number in 1979 (*1*, p. 382).

Additional Americans Killed, 1979–2002

The estimates cited are for the number of Americans who would not have been killed in 2002 if traffic fatality rates in the United States had declined by the same percentages as in the comparison countries. Calculating the corresponding differences for each of the intervening years and adding them up produces

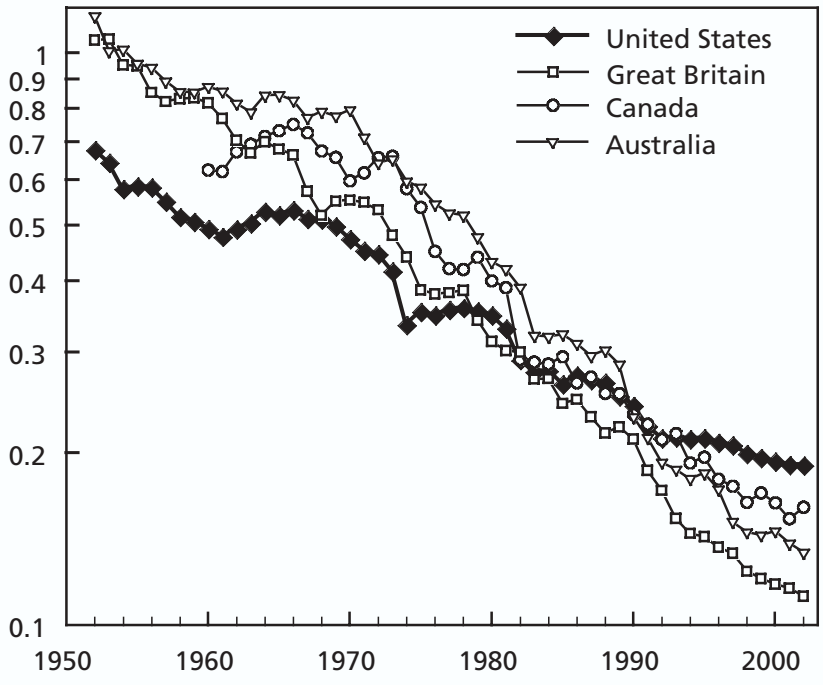


FIGURE 2 Traffic fatalities per 1,000 registered vehicles in the United States and in three comparison countries (*1*, p. 384).

a cumulative estimate of American lives that would not have been lost. The average of the totals for the rates of the three comparison countries is 214,286. Therefore, if U.S. safety progress had kept pace with progress in the comparison countries, approximately 200,000 fewer Americans would have died on our roads in the 23-year period.

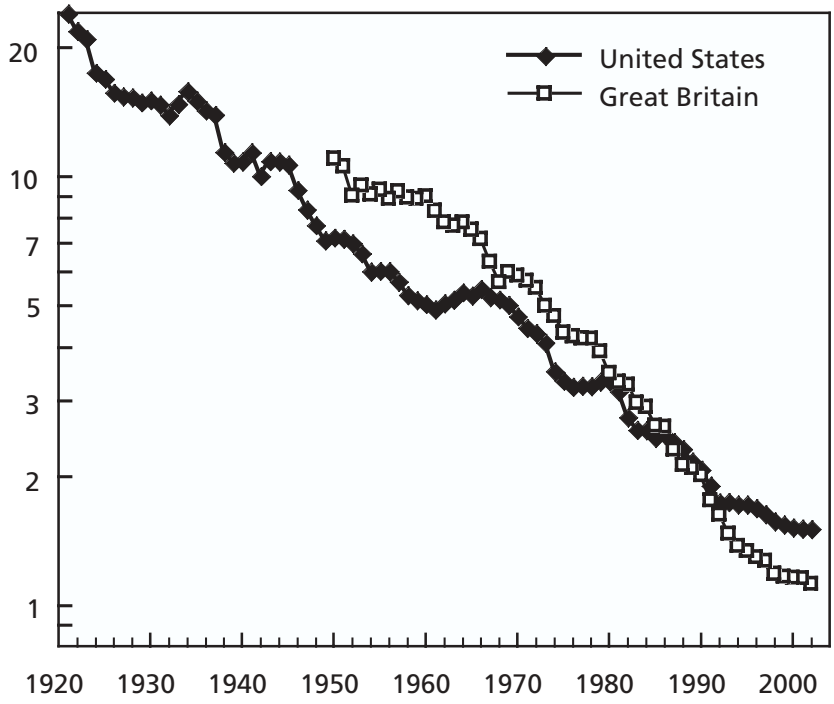
Different Rates, Same Picture

The estimate of fatalities that would have been prevented if U.S. performance had matched that of the comparison countries is relatively independent of the rate chosen. For example, the number of American lives that would have been saved in 2002 if the United States had matched the British rate of decline in raw fatalities is 15,217; at the vehicle rate, 16,605; and at the distance rate, 15,670.

If the percent growth in vehicles and growth in travel were identical in both countries for the 23-year period, the estimates would be identical. The difference computed for the vehicle rate reflects a higher percent of vehicle ownership growth in Britain, which had lower levels of vehicle ownership at the start. The difference computed at the distance rate reflects a slightly larger increase in total distance traveled in Britain compared with that in the United States.

The crucial point is that these are percent changes. Large, fairly stable differences between the countries should not much affect percent changes in time, because the influences on the 1979 and 2002 fatalities would be similar. For example, Britain is more urban than the United States and has a greater percent of pedestrian fatalities—but these factors do not differentially change all that much between 1979 and 2002.

FIGURE 3 Traffic fatalities per 100 million miles of vehicle travel in the United States and in Great Britain (*1*, p. 386).



Defining Progress

In his article, O'Neill correctly indicates progress in U.S. safety. If the data points for the other countries are removed from Figures 1, 2, and 3, the declines in U.S. rates appear impressive.

O'Neill identifies great variation among U.S. states and observes that some states had lower rates than those in the comparison countries. The reductions in the rates in the United States, however, are much less than in other countries. In all cases in Figures 2 and 3, the U.S. rates are higher in 2002 than the rates in the comparison countries, yet formerly the U.S. rates were lower.

Some U.S. states have lower rates than the aggregate national rates of the comparison countries. Similarly, regions, provinces, or states within the comparison countries also have rates that are lower than the national average. Progress is indicated not by the values in 2002 but by a comparison of the percent changes since 1979 with the changes in the three other countries.

Because the percent changes are similar over time for raw fatalities, the vehicle rate, and the distance rate, comparing the changes in an individual U.S. state's record of raw fatalities is the easiest approach. A drawback is that population growth was higher in some regions, such as the South, than in others, which contributes to increased fatalities; but the approach avoids the uncertainties of crashes by out-of-state vehicles or of unreliable estimates of travel distances.

Comparing 2002 and 1979 fatalities for all 50 states and the District of Columbia shows that only one state enjoyed a decline of more than 50 percent. In Vermont, fatalities declined from 159 in 1979 to 78 in 2002—a 50.9 percent drop. Although this state may be a statistical outlier because of the small numbers, the decline is less than the 51.1 percent achieved in Australia. The state with the second highest decline is Massachusetts, with 49.9 percent. All other states experienced smaller percent declines than any of the comparison countries.

States in the East and Midwest tended to have the largest percent declines, and those in the South the lowest—in 14 Southern states, fatalities increased. The District of Columbia had an increase of 6.0 percent, although the vehicle rate is low for all years because the district is urban.

As O'Neill observes, the variations among the states are due in part to differing policies on speed,

alcohol, and occupant protection devices. This supports my core thesis that public policy aimed at driver behavior really makes a difference. The vehicles in all states, however, are subject to identical safety standards. Comparing changes over time for the states shows that the failure of U.S. safety policy applied throughout the nation, even if not uniformly.

Search for an Explanation

Although straightforward analyses of publicly available data show some 200,000 additional U.S. fatalities over a 23-year period, identifying what measures would have made the difference is difficult. Safety belt use, for example, can account for a substantial portion of the difference. If the United States had introduced belt-wearing laws and achieved wearing rates on the same schedule as Canada, 95,000 fewer Americans would have died between 1979 and 2002. Why then did the United States not adopt this proven, effective intervention earlier? Moreover, what accounts for the other 100,000-plus additional deaths?

Such large and robust effects likely reflect fundamental differences in philosophy and approaches to traffic safety. U.S. policy has focused on vehicle factors—even on factors that research has shown are of minor importance. Public policies addressing such road-user behaviors as speeding, alcohol, traffic law violation, and belt wearing have been demonstrated to reduce casualties by large amounts but have not received appropriate attention. *Traffic Safety* explains how the United States embarked on this course, to which it still clings, resulting in the deaths of many Americans. The explanation involves analysis, documentation, references, and photographs that cannot be contained within the format of this article.[1]

In brief, the explanation draws on three interrelated observations:

- U.S. safety policy priorities have been ordered almost perfectly opposite to where technical knowledge shows benefits are greatest.
- This has occurred because lawyers who lack knowledge or interest in technical matters have defined and guided U.S. policy.
- This leadership is the result of the uniquely powerful influence of law on all aspects of U.S. society—an influence that is without parallel in any other country.

For example, evidence showed that airbags could kill children and had low effectiveness; nonetheless, a mandate to equip all vehicles with airbags became the top national safety goal in the 1970s. The commitment to the airbag mandate was used to oppose belt-wearing laws. An additional irony is that the media refer to the architects of the disaster described in this article as "safety advocates."

[1] As a supplement to this article, pages 389–411 of *Traffic Safety* are available at www.scienceservingsociety.com/TR.pdf, until July 2006.

Government Responsibility

Governments have major responsibilities for traffic. Governments traditionally have not been held responsible for the weather, yet when 1,000 people were killed by Hurricane Katrina, responsibility was attributed to various levels of government. The annual deaths of 42,000 Americans, and the daily deaths of 16 teenagers, in an entirely manmade system under government supervision do not generate corresponding attributions of responsibility. Protecting public health is a major government responsibility, and U.S. performance in the area of ground traffic safety has been abysmal compared with that of other countries.

In another transportation mode, however, U.S. safety performance is outstanding. In 2002 nobody was killed in U.S. commercial aviation. This success occurred because the focus was not on surviving crashes, but on preventing them. As long as our focus in ground transportation safety is on squeezing an elusive additional minor increment of survivability from crashes, we can never make acceptable progress. The relative lack of importance of vehicle factors is clear in comparing Canada and the United States—both nations have similar vehicles, yet Canada has cut the number of traffic deaths by half.

The one cause for optimism is that whenever the United States recognizes it has a problem, it moves with a speed and energy unequalled in other countries. By adopting new thinking, the United States can cut the number of fatalities in half with policies that the public would welcome (*1*, p. 412).

ALAN SCHEIN PHOTOGRAPHY/CORBIS

References

1. Evans, L. *Traffic Safety*. Science Serving Society, Bloomfield Hills, Mich., 2004. Additional information at www.scienceservingsociety.com.
2. O'Neill B. Improving U.S. Highway Safety: Have We Taken the Right Road? *TR News*, No. 239, July–August 2005, pp. 24–27.

SIGNALS is a guest editorial column, published on an occasional basis, that offers thought-provoking commentary by organizational leaders, to stimulate discussion on topics related to transportation research, practice, and policy. Reader response is encouraged in the form of letters to the editor.

RESEARCH PAYS OFF

Bikeways to Prosperity

Assessing the Economic Impact of Bicycle Facilities

JUDSON J. LAWRIE, THOMAS P. NORMAN, MARY MELETIOU, AND SARAH W. O'BRIEN

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Since 1987, the North Carolina Department of Transportation (DOT) and local governments have invested $6.7 million in public funds to construct an extensive network of bicycle facilities that consists of 55 miles of wide paved shoulders and multiuse pathways on the northern Outer Banks. North Carolina DOT commissioned the Institute for Transportation Research and Education (ITRE) at North Carolina State University to determine if the benefits gained from the bicycle facilities would justify investment in additional facilities throughout the state.

Problem

ITRE conducted a case study of bicycle tourism in the area. Measuring the benefits of this tourism was a challenge, because tourists visit the northern Outer Banks for a variety of reasons. Researchers needed a method to distinguish the tourists who bicycle as an incidental part of a vacation from those for whom bicycling is a major part of the attraction.

Solution

Two methods were considered for understanding the benefits—a benefit-cost analysis (BCA) and an economic impact analysis (EIA).

A BCA compares the value of the benefits with the cost of the investment and requires converting both the costs and the benefits into dollar amounts. Some benefits of bicycle facilities, however—such as reduced traffic congestion, increased safety, healthy activity, and improved air quality—are not easily quantified.

An EIA examines the economic benefits from tourists who visit for a specific tourist attraction or event. The benefits largely result from tourist spending on food, lodging, and entertainment—which are easier to quantify. The researchers therefore chose the EIA approach.

Three key pieces of information were gathered through surveys and through bicycle traffic counts:

- The average amount of money that tourists spend during a visit to the northern Outer Banks,
- The total annual number of tourists, and
- The proportion of tourists for whom bicycling was an important reason for the visit.

Bicycle Use and Characteristics

During a three-day period starting July 30, 2003, researchers developed a profile of area bicyclists by surveying 173 who were riding on the facilities—143 visitors and 30 residents. In addition, 392 tourists completed self-administered surveys at three area visitor centers over three months, starting in July 2003, to determine the percentage of respondents who engaged in bicycling on vacation.

Survey responses revealed spending patterns, trip information, attitudes and perceptions about bicycling and the facilities, investment priorities, and general demographics. Pneumatic tube counters calibrated for bicycle detection tallied users at 11 locations on a variety of bicycle facilities during a one-week period.

Economic Impact Analysis

Information from the Outer Banks Chamber of Commerce led researchers to estimate that 4 million tourists visit the study area annually. The visitor center surveys showed that 17 percent of these tourists do some bicycling on their trip. This translates to approximately 680,000 annual visitors who bicycle.

Survey station set up along a wide paved shoulder section of a bicycle facility.

Three survey questions addressed the degree to which these bicycling tourists were drawn to the area by bicycling and the bicycle facilities:

- "How important was the activity of bicycling in your decision to come to this area?"
- "How would you rate the overall quality of bicycle facilities in the area?"
- "How important will the quality of bicycling be in a decision for you to return?"

The answers to these questions yielded a conservative estimate that approximately 40,800 tourists each year—roughly 1 percent of the 4 million total visitors annually—were attracted to the Outer Banks to a significant degree by the bicycling activities. Estimated annual expenditures, projected from the spending patterns and trip duration data collected in the surveys, were then evaluated using an economic impact model. Accounting for data specific to the Outer Banks area, federal and state taxes and contributions, and economic multiplier effects, the model estimated an annual economic impact of $60 million and 1,407 jobs supported from the 40,800 visitors for whom bicycling was an important reason for choosing to vacation in the area.

Other Survey Findings

Of the survey respondents, 12 percent reported staying an extra three to four days to bicycle in the area. The perceived high quality of bicycling in the region had a positive effect on respondents' vacation experience and planning—55 percent indicated that the bicycle facilities helped them feel safer while riding, and 53 percent reported that bicycling influenced their decision to return in the future.

According to the survey, 9 out of 10 respondents strongly agreed that state and federal tax dollars should be used to build bicycle facilities. Nearly two-thirds of respondents indicated that additional bicycle facilities should be built.

Application

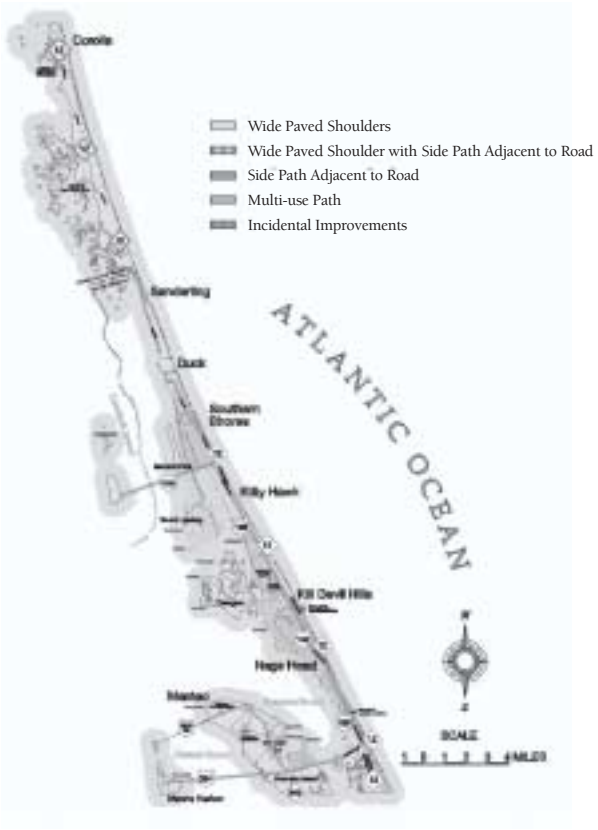
This research demonstrates a straightforward way to gauge the economic benefits of bicycle facilities. Similar research is needed in other regions to determine the change in economic impact that may result from different types of tourist attractions, geography, or a network of bicycle facilities.

The study shows that continued investment in bicycle facilities could be expected to increase the favorable economic impact—therefore additional investment is recommended. Lessons learned from this research are under consideration in other localities throughout the state.

Benefits

The ITRE study found that visitors who bicycle in the northern Outer Banks have a significant economic impact on the area. Moreover, the study provides evidence that the expenditure of public funds on bicycle facilities in an area with a substantial amount of tourism can be a worthwhile investment.

The annual economic impact of $60 million and 1,407 jobs supported is a reasonable but conservative estimate of the benefits. The estimate compares favorably with the $6.7 million in public funds invested in the construction of the bicycle facilities. That investment annually yields an economic return approximately nine times the initial expenditure.



Bicycle facilities of the northern Outer Banks.

The study suggests that public investment in a network of bicycle facilities in other coastal and resort areas could return similar benefits, whether the area attracts tourists primarily for bicycling or for other reasons. Because of the usefulness of the EIA findings, North Carolina DOT plans to study more bicycle and pedestrian facilities for the economic impact on local economies to allocate direct public funding most effectively.

For more information, contact Judson J. Lawrie, North Carolina State University, Institute for Transportation Research and Education, Centennial Campus Box 8601, Raleigh, NC 27695-8601; telephone 919-513-3482; fax 919-515-8898; e-mail jjlawrie@unity. ncsu.edu.

EDITOR'S NOTE: Appreciation is expressed to Peter Shaw and Joseph Morris, Transportation Research Board, for their efforts in developing this article.

Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, Keck 488, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-2952, e-mail gjayaprakash@nas.edu).

Michael E. Tardif

Washington State Attorney General's Office

As senior attorney in the Torts Division of the Washington State Attorney General's Office, Michael E. Tardif's responsibilities include handling major tort appeals and advising staff attorneys on major tort cases. He works on tort cases involving the regulatory activities of state government, such as securities regulation and industrial safety, and serves as legal adviser to the state Department of Transportation and other agencies on matters related to tort liability.

Tardif became involved in TRB in 1984 and joined the Task Force on Torts in 1987. He has served on several National Cooperative Highway Research Program project panels—currently for Best Methods and Practices of Data Integration for Transportation Departments and for Legal Problems Arising out of Highway Programs—and is an active member of the Tort Liability and Risk Management Committee and the Context-Sensitive Design and Solutions Task Force.

"It is important for decision makers to receive not only a good briefing on the law, but a straightforward and concise presentation on the historical and technical context of the transportation issue at hand."

"Involvement in TRB has proved valuable in two respects," Tardif observes. "First, TRB's initiatives for research on transportation legal issues and the work of the committees in the legal resources group have provided a lot of legal research that I have used in my cases. Second, TRB is a source of objective, high-quality research on transportation engineering issues and of access to legitimate transportation experts—invaluable in representing transportation agencies in litigation."

For lawyers planning a career in transportation law, Tardif recommends joining TRB committees and attending annual meeting and other conference sessions, such as the Annual Workshop on Transportation Law.

"Participating actively in committees and sessions by making presentations, serving on panels, and performing research enhance professional skills and contribute to the advancement of transportation law," he points out.

"My particular advice for transportation lawyers handling litigation is to make clear and complete presentations to courts of the factual and technical transportation issues involved," says Tardif. "It is important for decision makers to receive not only a good briefing on the law, but a straightforward and concise presentation on the historical and technical context of the transportation issue at hand."

For example, the 2003 case *Pierce County v. Guillen* involved a federal statute prohibiting state and federal courts from allowing use of certain federally required safety data in personal injury litigation against state and local transportation agencies. A state supreme court had declared the federal statute unconstitutional. Tardif wrote a multistate amicus brief, asking the U.S. Supreme Court to reverse the state court's decision.

In developing the presentation to the U. S. Supreme Court, Tardif and his team decided not to emphasize principles of constitutional law but to trace the history of the federal highway safety statutes. The court unanimously reversed the state opinion and upheld the constitutionality of the federal law.

"The U.S. Supreme Court opinion was 16 pages long, but the facts, history, context, and interpretation of the federal statute took up 15 pages," Tardif notes. "Only one page dealt with the legal issue under the commerce clause of the U.S. Constitution."

Tardif is a member of the Washington State Trial Lawyers Association, the Washington Defense Trial Lawyers Association, and the Government Lawyers Association. He has written legal education materials for these organizations and for state and local bar associations. With Washington State Attorney General Rob McKenna, he coauthored "Washington State's 45-Year Experiment in Governmental Liability," the lead article in a 2005 volume of the *Seattle University Law Review.*

Tardif graduated from Seattle University and earned his law degree at the University of Washington and an MBA at the University of Puget Sound. By then he had joined the state's Office of the Attorney General, holding a succession of assignments culminating in service as chief of the torts division of 50-plus attorneys from 1987 to 2001, when he took his current senior attorney post.

During his career, Tardif has represented government agencies involved in a spectrum of activities including law enforcement, social welfare, corrections, and regulation. He has served on the state Risk Management Advisory Committee and the Management Service Advisory Committee. Although much of his tort work has been related to transportation, he also defends cases involving liability for civil rights, employment, regulatory, law enforcement, and social welfare issues.

"Liability and damage theories from these other areas of tort law have increasingly become evident in cases involving transportation," Tardif reports. "This variety of experience has been helpful in defending transportation claims."

John Mason

Science Applications International Corporation

John Mason has distinguished himself in three careers: first as a U.S. Army officer, retiring as a colonel; then as a division and operations manager, vice president, and now consultant at Science Applications International Corporation (SAIC); and as an elected council member and six-term mayor of the City of Fairfax, Virginia.

In the Army, he served two tours in Vietnam, first as an adviser to a Vietnamese railway security battalion and then as commander of a U.S. Army armored cavalry squadron of 1,200 soldiers. At SAIC, he has been a leader in the development of the company's transportation consulting business. As mayor, he has participated in several transportation policy initiatives for the national capital region and Virginia.

Mason concluded his Army career at the Pentagon as Assistant Director, Operations and Readiness Directorate, and joined SAIC, an employee-owned research and engineering firm. He was the first director of the company's Transportation and Policy Analysis Center, managing SAIC's operations, research, and analysis support for the Volpe National Transportation Systems Center. He also was the program manager for SAIC's support to the Federal Highway Administration (FHWA) Office of Operations and continues to assist FHWA on regional transportation policy and decision-making issues.

"I would urge that newcomers in the civic arena or in a transportation consulting role do the homework to understand not only the technical aspects of the transportation issues, but also the decision-making process and what motivates leaders to get things done."

Volunteer community service led to Mason's election to the Fairfax city council in 1986, followed by six successive terms as mayor from 1990 to 2002.

"It's been fortunate that my civic life as mayor and my professional life as transportation consultant have been complementary," Mason comments. "The key to being effective in a civic role and successful in the consulting arena is building teams of good people."

Located "at the crossroads of Northern Virginia," with "some 350,000 vehicle-trips per day," Fairfax owns and operates its highway and street system, as well as its own bus system.

"In the mid-1990s, the City of Fairfax was among the leaders in Northern Virginia with technology initiatives such as traffic light synchronization and coordination," Mason notes. "We were the first jurisdiction in Virginia to install cameras at intersections that had patterns of red-light running." Despite favorable results, he reports, the cameras were removed in 2005 after the state's General Assembly decided not to renew the legislation.

Mason's involvement in regional transportation issues was inevitable. As a member of the National Capital Region Transportation Planning Board, he chaired its Vision Steering Committee, which drafted the goals, objectives, and strategies for long-range transportation planning for metropolitan Washington, D.C. Mason also served as vice-chair of the Transportation Coordinating Council of Northern Virginia, chaired the I-66 Major Investment Study Policy Advisory Committee, and was a member of the Northern Virginia Transportation Commission.

He served as vice-chair for transportation on the Regional Emergency Response Task Force convened by the Metropolitan Washington Council of Governments after the September 11, 2001, terrorist attacks. He led the design of an innovative information-sharing approach for the many transportation agencies and jurisdictions in the region. He is a past chair of the board of directors of the Association of Metropolitan Planning Organizations.

In 2004, Mason was appointed to the Governor's Commission on Rail Enhancement in Virginia for the 21st Century, which drafted future rail policy for the state. He has authored an array of transportation-related papers and articles, including reports on operations planning, intelligent transportation systems, national transportation strategic planning, and "How to Communicate with Elected Officials," which appeared in the February 2004 *ITE Journal*.

"I would urge that newcomers in the civic arena or in a transportation consulting role do the homework to understand not only the technical aspects of the transportation issues, but also the decision-making process and what motivates leaders to get things done," he advises.

Involved in many community cultural activities, Mason is president of the board of directors for the Fairfax Symphony Orchestra. He graduated from the University of Massachusetts with a degree in history and earned a master's degree in political science from New York University.

Mason has served TRB as a member of the National Cooperative Highway Research Program Oversight Panel for a Future Strategic Highway Research Program and of the Regional Transportation Systems Management and Operations Committee. He chaired the TRB Committee on Developing a Regional Concept for Managing Surface Transportation Operations.

TRB HIGHLIGHTS

STARTING UP—The oversight committee for TRB's new Airport Cooperative Research Program conducted its first meeting, January 30–31, at the National Academies Keck Center, Washington, D.C. Participants included (*left to right:*) Catherine Lang, Federal Aviation Administration; TRB Executive Director Robert E. Skinner, Jr.; Richard Marchi, Airports Council International–North America; TRB Cooperative Research Programs Director Robert Reilly; Paul McGraw, Air Transport Association of America, Inc.; and Gina Marie Lindsey, McBee Strategic Consulting.

TRANSIT IDEAS—The Transit Innovations Deserving Exploratory Analysis (IDEA) program panel reviewed a project to develop a chemical and biological decontamination system for subway stations, at a meeting January 6 in Washington, D.C. Participants included *(clockwise, from foreground)* Katherine Turnbull, Texas Transportation Institute; Joe Henebury, U.S. Department of Transportation; Paul Messina, New York City Transit; Lewis Clopton, Federal Transit Administration (FTA); Frank Lonyai, Metropolitan Transportation Authority of Los Angeles County; TRB Senior Program Officer Stephan Parker; Fred Gilliam, Capital Metropolitan Transit Authority (Austin, Texas), panel chair; TRB Senior Program Officer Harvey Berlin; Barry Barker, Transit Authority of River City (Kentucky); and Joan LeLacheir of the Washington Metropolitan Area Transit Authority. The panel also selected several proposals for project contracts.

The Transit IDEA Program supports innovative approaches to advance transit practice. The program funds applied research and development to improve the efficiency, safety, security, maintenance, and ridership of transit systems. The program is funded by the Transit Cooperative Research Program sponsored by FTA. For more information, see the IDEA website at www.TRB.org/idea.

INTERNATIONAL EXCHANGE—Panel members for NCHRP Project 20-36, Highway Research and Technology: International Information Sharing, met in November 2005 in Washington, D.C., to review project activities and the budget. Since 1993, the project has supported participation by state department of transportation (DOT) professionals in international highway technology scans and on technical committees of PIARC, the World Road Association. The project also assists in the implementation of scan findings. The session included (*clockwise, from foreground*) Hana Maier, Federal Highway Administration (FHWA); C. Michael Walton, University of Texas–Austin; Larry R. Goode, North Carolina DOT (retired); C. Franklin Gee, Virginia DOT (retired); Ken Kobetsky, American Association of State Highway and Transportation Officials (AASHTO); William P. Carr, District DOT; Amir N. Hanna, NCHRP; panel chair James F. Byrnes, Jr., Parsons Brinckerhoff Quade and Douglas; Francis B. Francois, Consultant; Bob Bryant, AASHTO and Oregon DOT; Terry Halkyard, FHWA; and Richard C. Long, Florida DOT.

IN MEMORIAM

Alan M. Voorhees 1922–2005

Alan M. Voorhees, NAE, internationally renowned pioneer in urban transportation planning and an influential writer on planning standards and methods, died in Richmond, Virginia, on December 18. Active in TRB, he served as chairman of the Executive Committee in 1973.

Voorhees developed a mathematical model to forecast traffic patterns; the model was used in the design and construction of the Interstate Highway System and around the world to plan highways, office and shopping complexes, and subway systems. He began his professional career in 1949 as city planning engineer for the City of Colorado Springs. He joined the staff of the Automobile Safety Foundation in Washington, D.C., in 1952 as a planning engineer.

In 1961, he founded the transportation consulting firm of Alan M. Voorhees & Associates, which planned many of the metropolitan transit systems built in the free world in the 1960s and 1970s. He contributed to several textbooks and manuals, including the guide *Better Transportation for Your City*.

In the late 1970s, Voorhees was appointed dean of the College of Architecture, Art, and Urban Sciences at the University of Illinois at Chicago. In 1980 he founded Atlantic Southeast Airlines, which became a subsidiary of Delta Air Lines. He collaborated in expanding Autometric, Inc., a mapping and reconnaissance firm, and founded Summit Enterprises, a real estate holding company.

His awards and honors include the first Harland Bartholomew Award of the American Society of Civil Engineers, for his contributions to urban planning; and election in 2000 to the National Academy of Engineering, for his development and application of quantitative relationships between urban land uses and traffic flows. Rutgers University created the Alan M. Voorhees Transportation Center in his honor in 1998. He was a Fellow of the American Institute of Certified Planners.

Voorhees was a veteran of World War II. He received a Silver and a Bronze Star for his service in the Pacific with Underwater Demolition Team 11, an elite Navy unit that was a precursor to the Seals.

Voorhees completed a degree in civil engineering at Rensselaer Polytechnic Institute and in city planning at the Massachusetts Institute of Technology. He earned a certificate from the Yale University Bureau of Highway Traffic.

In addition to his service on TRB's Executive Committee, he chaired the Technical Activities Council from 1971 to 1972 and was a member of several TRB standing committees. He chaired the Project Committee on Highway Capacity Subcommittee on Definitions (1960–1968) and the Project Committee on Origin and Destination (1965–1970).

David K. Witheford 1928–2005

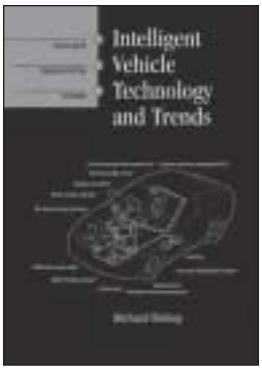
David K. Witheford, a civil engineer and retired TRB senior program officer, died November 18 in Arlington, Virginia. A native of Sheffield, England, he came to the United States in 1941. He graduated from Swarthmore College and received a certificate from the Yale University Bureau of Highway Traffic. His areas of special interest were urban transportation planning and traffic and highway engineering.

Witheford served on 50 TRB committees, mostly as TRB staff or liaison representative, and chaired the Subcommittee on Criteria for the Design and Application of No Passing Zones. He joined the TRB staff as a projects engineer with the National Cooperative Highway Research Program in 1973; two years later, he was appointed assistant program director. In 1979 he transferred to the Technical Activities Division as senior program officer and engineer of traffic and operations. He retired in January 1989 but continued to work as a consultant on highway-related topics for the next 10 years.

Before coming to TRB, Witheford was technical director for the Eno Transportation Foundation. He also had worked for the Yale Bureau of Highway Traffic, for the Pittsburgh Area Transportation Study, and for the Delaware State Highway Department. During the Korean War, he served in the U.S. Army in Japan as engineering officer with the Japan Construction Agency.

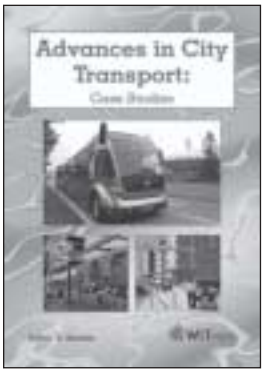
Witheford was the author of many technical publications. He participated on committees of the American Society of Civil Engineers and the Institute of Transportation Engineers.

BOOK SHELF



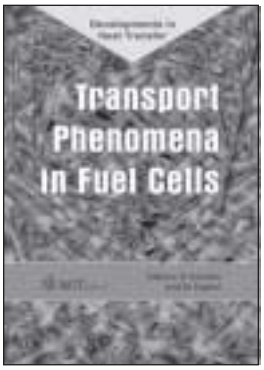
Intelligent Vehicle Technology and Trends
Richard Bishop. Artech House, Norwood, Massachusetts, 2005; 366 pp.; $89; 1-58053-911-4.

This book presents a comprehensive overview of the workings of intelligent vehicle systems and of the issues involved in introducing the systems into road vehicles. Real-world products are examined, along with practical considerations such as market aspects and user acceptance. The author discusses government and industry strategies and offers a view of the future. A member of the TRB Vehicle–Highway Automation Committee, Bishop intends to raise awareness of intelligent vehicle technology among audiences not directly involved in developing the systems.



Round Table 127: Time and Transport
Alan Deardorff, Yves Crozet, Lori Tavasszy, and Nils Bruzelius. European Conference of Ministers of Transport. Organisation for Economic Co-Operation and Development, Paris, France, 2005; 130 pp.; $50; 92-821-2330-8.

Participants in this roundtable revisited the extensive literature on the valuation of passenger time and discussed the underresearched topic of the value of time in freight transport. Reports address the importance of the cost and time of transport for international trade, time and passenger transport, and the logistics perspective—the state of the art and research challenges—on the value of freight transport time.



Round Table 129: Transport Services: The Limits of (De)regulation
Günter Knieps, Antonio Estache, Tomas Serebrisky, Dominique Bouf, Julien Leveque, and Marco Ponti. European Conference of Ministers of Transport. Organisation for Economic Co-Operation and Development, Paris, France, 2005; 164 pp.; $63; 92-821-2345-6.

Although deregulation and privatization in the transport sector have led to increases in productivity, reforms in the provision of infrastructure services have not led to the mobilization of private resources, and concession relations have been less successful than envisioned. Reports address current issues in reform and the results from delimiting regulatory needs, deregulating transport infrastructure and public–private partnerships, and competing for transport infrastructure services, as well as the theoretical and policy issues surrounding the regulation of transport services and infrastructure. Rapporteur Ponti is an individual affiliate of TRB.

Advances in City Transport: Case Studies
S. Basbas, ed. Advances in Transport Series, Vol. 17. WIT Press, Southampton, United Kingdom; Billerica, Massachusetts, 2005; 208 pp.; $120; 1-85312-799-X.

City transport systems are a challenge around the world to the engineers and planners who must make decisions that affect people's daily lives and the quality of the environment. An overview introduces several transportation systems, along with their plans and solutions: Adelaide, Australia; Bangalore, India; Bilbao, Spain; the Netherlands; Santiago, Chile; São Paulo, Brazil; Singapore; and Thessaloniki, Greece. The effect of traffic on air quality is a prominent topic in each case study.

Transport Phenomena in Fuel Cells
B. Sundén and M. Faghri, eds. Developments in Heat Transfer Series, Vol. 19. WIT Press, Southampton, United Kingdom; Billerica, Massachusetts, 2005; 432 pp.; $195; 1-85312-840-6.

Fuel cells are expected to play a significant role in the next generation of energy systems and road vehicles. This book examines the potential transportation uses of solid oxide fuel cells, proton exchange membrane fuel cells, and direct methanol fuel cells. Also presented are detailed summaries of state-of-the-art knowledge and future needs.

The books in this section are not TRB publications. To order, contact the publisher listed.

TRB PUBLICATIONS

Aggregate Properties and the Performance of Superpave-Designed Hot-Mix Asphalt
NCHRP Report 539
This report offers a critical review of the post-1993 technical literature on the impact of the aggregate criteria specified by the Superpave® mix design method on the performance of hot-mix asphalt (HMA). The goal was to identify criteria with demonstrated positive relationships with HMA performance and to estimate the significance of the relationships. The report will be of interest to materials engineers in state highway agencies, as well as to materials supplier and paving contractor personnel responsible for the production of aggregates and HMA.

2005; 90 pp.; TRB affiliates: $17.25; TRB nonaffiliates: $23. Subscriber category: materials and construction (IIIB).

TRB PUBLICATIONS *(continued)*

Guidelines for Early-Opening-to-Traffic Portland Cement Concrete for Pavement Rehabilitation
NCHRP Report 540
Guidelines are presented to facilitate the use of early-opening-to-traffic (EOT) concrete for pavement rehabilitation by highway agencies, reducing pavement closures and accruing economic and environmental benefits. The guidelines address proportioning, testing, construction, and other aspects of EOT concrete to achieve long-term performance, durability, and cost-effectiveness.

2005; 28 pp.; TRB affiliates: $15; TRB nonaffiliates: $20. Subscriber categories: pavement design, management, and performance (IIB); materials and construction (IIIB).

Integrated Roadside Vegetation Management
NCHRP Synthesis 341
Research and current practices in integrated roadside vegetation management are documented in this synthesis, along with reports on the incorporation of the decision-making processes into highway project planning, design, construction, and maintenance. A survey of 26 transportation agencies and a review of the literature have yielded a compendium of successful practices for potential implementation by other state DOTs.

2005; 80 pp.; TRB affiliates: $12.75; TRB nonaffiliates: $17. Subscriber categories: energy and environment (IB); highway and facility design (IIA).

Chip Seal Best Practices
NCHRP Synthesis 342
This synthesis presents an overview of successful chip seal practices in the United States, Canada, and overseas. With a goal of assisting in the development and implementation of pavement preservation programs, the volume describes the benefits of chip seal as part of a preventive maintenance program. Approximately 40 best practices in chip seal design methods, contract administration, equipment use, construction, and performance measures are identified.

2005; 111 pp.; TRB affiliates: $13.50; TRB nonaffiliates: $18. Subscriber categories: materials and construction (IIIB); maintenance (IIIC).

Management of Disadvantaged Business Enterprise Issues in Construction Contracting
NCHRP Synthesis 343
State transportation agencies have taken different approaches to the requirements in the Disadvantaged Business Enterprise (DBE) regulations revised in February 1999. This synthesis presents the approaches, generally covering all DBE programs, but with specific focus on the highway transportation sector.

2005; 97 pp.; TRB affiliates: $13.50; TRB nonaffiliates: $18. Subscriber categories: planning and administration (IA); materials and construction (IIIB).

Winter Highway Operations
NCHRP Synthesis 344
Changes that occurred between 1994 and 2004 in practices and strategies to control the impacts of winter weather on the safe and efficient movement of traffic are examined. The information is directed to an audience of frontline and midlevel supervisory winter maintenance decision makers and planners.

2005; 66 pp.; TRB affiliates: $12.75; TRB nonaffiliates: $17. Subscriber category: maintenance (IIIC).

Track-Related Research: Friction Control Methods Used by the Transit Industry
TCRP Report 71, Volume 4
A variety of onboard and wayside friction control applications for transit rail are described, including appropriate uses and operational issues. Guidelines are given for selecting various types of friction control technologies. The material should be of interest and assistance to engineers involved in the design, construction, maintenance, and operation of rail transit systems.

2005; 72 pp.; TRB affiliates: $16.50; TRB nonaffiliates: $22. Subscriber categories: public transit (VI); rail (VII).

Track-Related Research: Flange Climb Derailment Criteria and Wheel–Rail Profile Management and Maintenance Guidelines for Transit Operations
TCRP Report 71, Volume 5
Flange climb derailment criteria for transit vehicles, including lateral-to-vertical ratio limits and a corresponding flange-climb distance limit, are presented. Guidance is offered on wheel and rail maintenance practices for transit agencies.

2005; 140 pp.; TRB affiliates: $18.75; TRB nonaffiliates: $25. Subscriber categories: public transit (VI); rail (VII).

Practices in No-Show and Late Cancellation Policies for ADA Paratransit
TCRP Synthesis 60
This synthesis documents current and innovative practices of U.S. transit agencies in developing and implementing passenger no-show and late cancellation policies for paratransit programs operated under the requirements of the Americans with Disabilities Act of 1990 (ADA). The administration, community response, and effectiveness of policies are described for small, medium, and large transit agencies. The report examines how the policies can improve system productivity, efficiency, and capacity, as well as service for riders with disabilities, who may experience difficulties with the advance reservation procedures of many ADA complementary paratransit operations.

2005; 49 pp.; TRB affiliates: $12; TRB nonaffiliates: $16. Subscriber category: public transit (VI).

To order the TRB titles described in Bookshelf, visit the TRB online Bookstore, www.TRB.org/bookstore/, or contact the Business Office at 202-334-3213.

CALENDAR

TRB Meetings 2006

March

27–28 Safety Data Analysis Tools Workshop (*by invitation*)
Washington, D.C.
Richard Pain

27–29 AASHTO Symposium on Geographic Information Systems for Transportation *
Columbus, Ohio
Thomas Palmerlee

28–30 Transportation and Economic Development 2006*
Little Rock, Arkansas

April

5–6 Research to Enhance Rail Network Performance: A Workshop (*by invitation*)
Washington, D.C.
Elaine King

9–11 10th National Light Rail Transit Conference: Light Rail—A World of Applications and Opportunities*
St. Louis, Missouri
Peter Shaw

26–28 8th Annual National Harbor Safety Committee Conference*
Washington, D.C.
Joedy Cambridge

May

3–4 Environmental Geospatial Information for Transportation: A Multidisciplinary Examination of Noteworthy Practices (*by invitation*)
Thomas Palmerlee

17–19 6th National Aviation System Planning Symposium
Daytona Beach, Florida

June

4–7 North American Travel Monitoring Exposition and Conference
Minneapolis, Minnesota
Thomas Palmerlee

4–7 1st International Symposium on Freeway Operations* (*by invitation*)
Athens, Greece
Richard Cunard

July

8 Challenges of Data for Performance Measures (*by invitation*)
La Jolla, California
Thomas Palmerlee

9–11 TRB 2006 Summer Conference
La Jolla, California
Mark Norman

9–11 31st Annual Summer Ports, Waterways, Freight, and International Trade Conference
La Jolla, California

16–19 3rd International Conference on Bridge Maintenance, Safety, and Management*
Porto, Portugal

16–20 11th AASHTO–TRB Maintenance Management Conference*
Charleston, South Carolina

23–26 45th Annual Workshop on Transportation Law
Chicago, Illinois
James McDaniel

25–29 5th International Symposium on Highway Capacity*
Yokohama, Japan
Richard Cunard

30–Aug. 3 2nd International Symposium on Transportation Technology Transfer*
St. Petersburg, Florida
Kimberly Fisher

August

TBD 7th National Access Management Conference
Park City, Utah
Kimberly Fisher

2–4 3rd Bus Rapid Transit Conference
Toronto, Ontario, Canada
Peter Shaw

6–9 1st International Conference on Fatigue and Fracture in the Infrastructure: Bridges and Structures of the 21st Century*
Philadelphia, Pennsylvania
Stephen Maher

23–26 7th International Conference on Short and Medium Span Bridges*
Montreal, Quebec, Canada
Stephen Maher

Additional information on TRB meetings, including calls for abstracts, meeting registration, and hotel reservations, is available at www.TRB.org/calendar. To reach the TRB staff contacts, telephone 202-334-2934, fax 202-334-2003, or e-mail lkarson@nas.edu. Meetings listed without a TRB staff contact have direct links from the TRB calendar web page.

*TRB is cosponsor of the meeting.

INFORMATION FOR CONTRIBUTORS TO

TR NEWS

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. Authors receive a copy of the edited manuscript for review. Original artwork is 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, typed pages). Authors also should 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 improve a reader's understanding of 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 photographs 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 appears. 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. Notices of meetings should be submitted at least 4 to 6 months before the event.

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, price, and ISBN. Publishers are invited to submit copies of new publications for announcement.

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 sent to the Director, Publications Office, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, telephone 202-334-2972, or e-mail jawan@nas.edu.

- All manuscripts should be supplied in 12-point type, double-spaced, in Microsoft Word 6.0 or WordPerfect 6.1 or higher versions, on a diskette or as an e-mail attachment.
- Submit original artwork if possible. Glossy, high-quality black-and-white photographs, color photographs, and slides are acceptable. Digital continuous-tone images must be submitted as TIFF or JPEG files and must be at least 3 in. by 5 in. with a resolution of 300 dpi or greater. A caption should be supplied for each graphic element.
- Use the units of measurement from the research described and provide conversions in parentheses, as appropriate. The International System of Units (SI), the updated version of the metric system, is preferred. In the text, the SI units should be followed, when appropriate, by the U.S. customary equivalent units in parentheses. In figures and tables, the base unit conversions should be provided in a footnote.

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Addressing Transportation's Critical Issues

Congestion, emergencies, energy and environment, equity, finance, human and intellectual capital, infrastructure, institutions, and safety are the critical issues in transportation that challenge the nation. Addressing these challenges will require new ideas, creativity, and innovation. TRB has produced an array of information to help transportation professionals and decision makers address the critical issues. Recent TRB publications of interest include the following:

Critical Issues in Transportation
TRB Miscellaneous Publication, 16 pages, 8.5 x 11, free (2006) (Included in this magazine; to order additional copies, contact Russell Houston at rhouston@nas.edu.)

The Fuel Tax and Alternatives for Transportation Funding
TRB Special Report 285, 6 x 9, paperback, on press—forthcoming April 2006

Future Truck and Bus Safety Research Opportunities
TRB Conference Proceedings 38, 8.5 x 11, paperback, on press—forthcoming April 2006

Integrating Sustainability into the Transportation Planning Process
TRB Conference Proceedings 37, ISBN 0-309-09418-6, 59 pages, 8.5 x 11, paperback, $33.00 (2005)

Guide for Emergency Transportation Operations
National Cooperative Highway Research Program (NCHRP) Report 525, Vol. 6, ISBN 0-309-08829-1, 56 pages, 8.5 x 11, paperback, $21.00 (2005)

State Construction Quality Assurance Programs
NCHRP Synthesis 346, ISBN 0-309-09749-5, 75 pages, 8.5 x 11, paperback, $17.00 (2005)

Strategies to Increase Coordination of Transportation Services for the Transportation Disadvantaged
Transit Cooperative Research Program Report 105, ISBN 0-309-08813-5, 77 pages, 8.5 x 11, paperback, $31.00 (2004)

The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement
TRB Special Report 279, ISBN 0-309-09452-6, 180 pages, 6 x 9, paperback, $24.00 (2003)

The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies
TRB Special Report 275, ISBN 0-309-08563-2, 186 pages, 6 x 9, paperback, $23.00 (2003)

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