FY 2003 Performance Report

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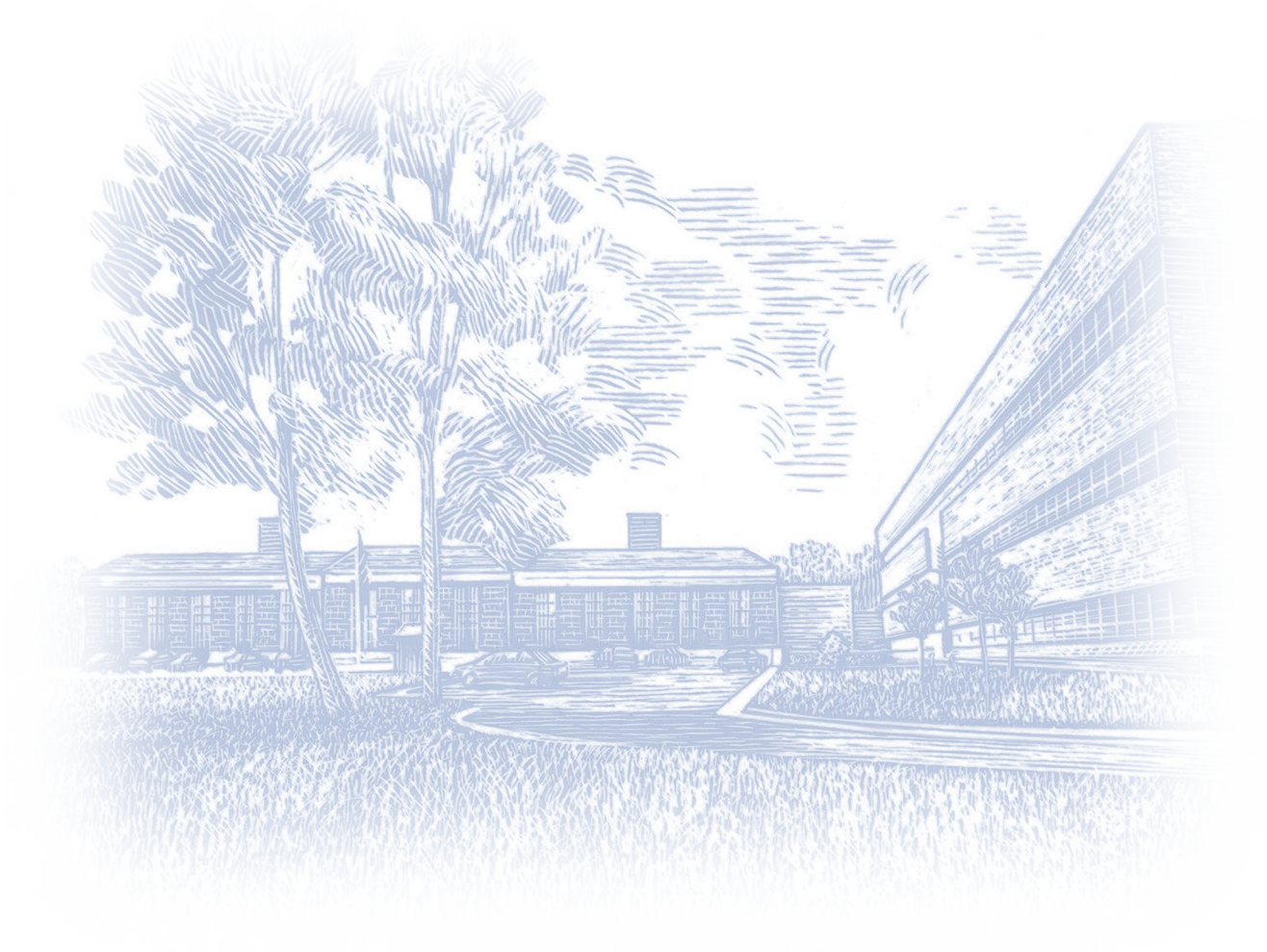

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Turner-Fairbank Highway Research Center
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WELCOME

The Office of Research, Development, and Technology (RD&T) provides leadership to the Federal Highway Administration (FHWA) Research and Technology (R&T) Program and plays a key role in guiding the Agency's R&T Leadership Team as it implements the Corporate Master Plan for Research and Deployment of Technology & Innovation. The FHWA R&T program directly supports the goals of the U.S. Department of Transportation (USDOT) and focuses on addressing significant transportation challenges that our Nation faces today. At FHWA, our mission of "Enhancing Mobility through Innovation, Leadership, and Public Service" and our role as "Innovators for a Better Future" reinforces the importance of technology and innovation (T&I) to the Nation's transportation system and our customers. FHWA's research leadership emphasizes information-sharing and partnerships with State and local governments, academia, and the private sector to quickly and cost-effectively transform new technologies and concepts into better transportation systems, processes, and services.

The Turner-Fairbank Highway Research Center (TFHRC) facility is a federally owned and operated research facility in McLean, VA, that contains more than 24 indoor and outdoor laboratories (labs) and support facilities, providing advanced research and development (R&D) innovations for U.S. and international highways. TFHRC houses more than 300 Federal and contract transportation researchers, students, and support personnel. This, our second annual performance report, represents our office's commitment to accountability in the programs and initiatives managed at TFHRC. The first part of the report provides additional insight into our research facility, personnel skill levels, programs, and initiatives. Not only does the report highlight our accomplishments and success stories of the past year, but it also conveys our management philosophy and the strategies we employ to achieve our goals and address new challenges. Additionally, it includes examples of how our organization strives to "give back" and enhance the quality of life for our local community. This is a companion document to the Fiscal Year (FY) 2002/2003 Performance Plan and 2002/2003 Catalog of Products and Services.

We hope that this report encourages you to learn more about RD&T's people, labs, services, and research. Our office undertakes and completes research that is essential, indispensable, and connected to our stakeholders. I sincerely welcome your feedback on this performance report and encourage you to provide comments and improvement suggestions through the TFHRC Web site at https://www.fhwa.dot.gov/research/tfhrc/. A "Performance Report Feedback" link was added to our home page to encourage and facilitate your input. Thank you for letting us know how we may better serve you.

Dennis C. Judycki
Associate Administrator for Research, Development, and Technology

WHO WE ARE AND WHAT WE DO

We continually seek to promote partnerships with State and local governments, academia, and the private sector to quickly and cost-effectively transform new technologies, concepts, and ideas into better transportation systems, processes, and services.

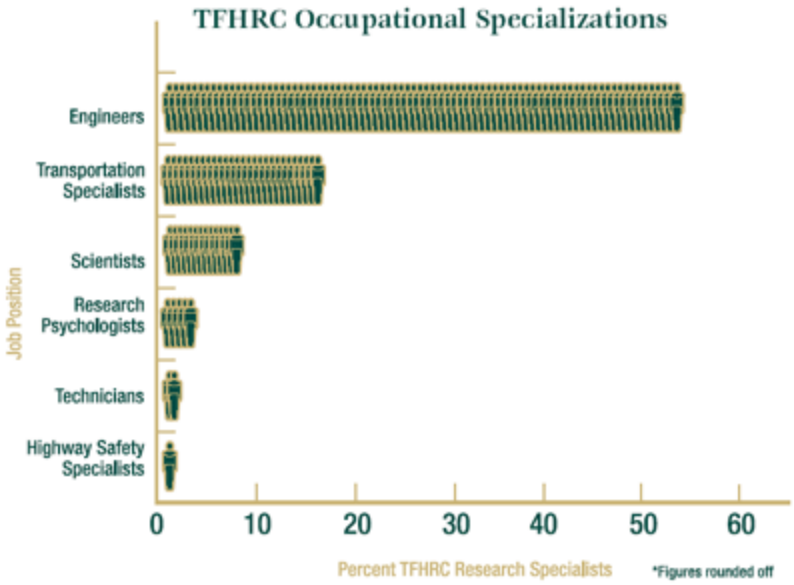
The R&T process is a continuous one that involves regular feedback throughout the various phases to drive strategic decisionmaking. To carry out the program effectively and efficiently, the Office of RD&T develops and executes policy, budget, program management, and evaluations that support the overall R&T program. RD&T projects span many disciplines and transportation topics, from highway design, engineering, and maintenance to economic analysis, human factors, travel surveys, outreach, and marketing.

RD&T has six offices involved in research and program support activities at TFHRC. The Office of Safety R&D, Office of Operations R&D, and Office of Infrastructure R&D conduct research that continually improves highway safety, operations, and infrastructure, respectively. More than 300 employees and contractors at TFHRC work in a variety of occupations and specialties; job positions include engineers, scientists, psychologists, and program support specialistsfrom a variety of disciplines. Our activities cover major subject-matter areas such as human-centered systems, materialstechnology, operations and intelligent transportation systems (ITS), pavements, safety, and structures. More than 50 percent of RD&T staff have advanced degrees; 20 percent hold one or more doctoral degrees.

In addition, our organization serves as the focal point for FHWA participation in cooperative research activities, such as the National Cooperative Highway Research Program (NCHRP) and the Transportation Pooled Fund (TPF) program. In FY 2003, the TPF program included 139 FHWA-led projects and 151 State-led projects valued at approximately $130 million—with the average study valued around $467,000. Each project averaged 7 partners for State-led projects and 9.8 for those led by FHWA. RD&T also conducts outreach to universities and the small-business community.

Our approach to research supports FHWA's emphasis on cooperation, information sharing, and formal research agenda development within USDOT and across the entire government. We continually seek to promote partnerships with State and local governments, academia, and the private sector to quickly and cost-effectively transform new technologies and concepts into better transportation systems, processes, and services. Appendices D and E of this report provide an overview of the extensive partnership activities that involve FHWA. Our emphasis on conducting world-class research includes a commitment to improve our business processes and efficiently operate the RD&T facilities, organization, and programs. Our business process improvements are highlighted in the "Challenges and Commitments" section of this report and the "Services" tables in appendix B.

Career development and enrichment are key focus areas for our organization. FHWA offers a variety of educational outreach and career development programs, including FHWA's Professional Development Program (PDP), the USDOT-wide Summer Transportation Internship Program for Diverse Groups (STIPDG), and Federal Government-wide programs such as the Executive Leadership Program and the Executive Potential Program. RD&T is committed to reaping the benefits of the diverse new perspectives and fresh ideas that these program participants offer. We aggressively seek and provide new learning opportunities for program participants whenever possible. For more information on this, see appendix E.



TFHRC Occupational Specializations

In addition to educational outreach, RD&T provides a variety of marketing and communications services that support FHWA T&I deployment initiatives. These services include marketing and communications strategic planning, exhibits, special events planning, and report and periodical publishing, including Public Roads, R&T Transporter, and Focus.

RD&T Organization

Infrastructure R&D (HRDI)

The Office of Infrastructure R&D focuses on improving the performance of highway infrastructure and significantly reducing associated long-term costs. The comprehensive and coordinated Infrastructure research program utilizes R&T that cuts across the boundaries of Asset Management, Pavements, and Structures. It focuses on the four critical elements needed for success: information, people, technology, and deployment of that technology.

Operations R&D (HRDO)

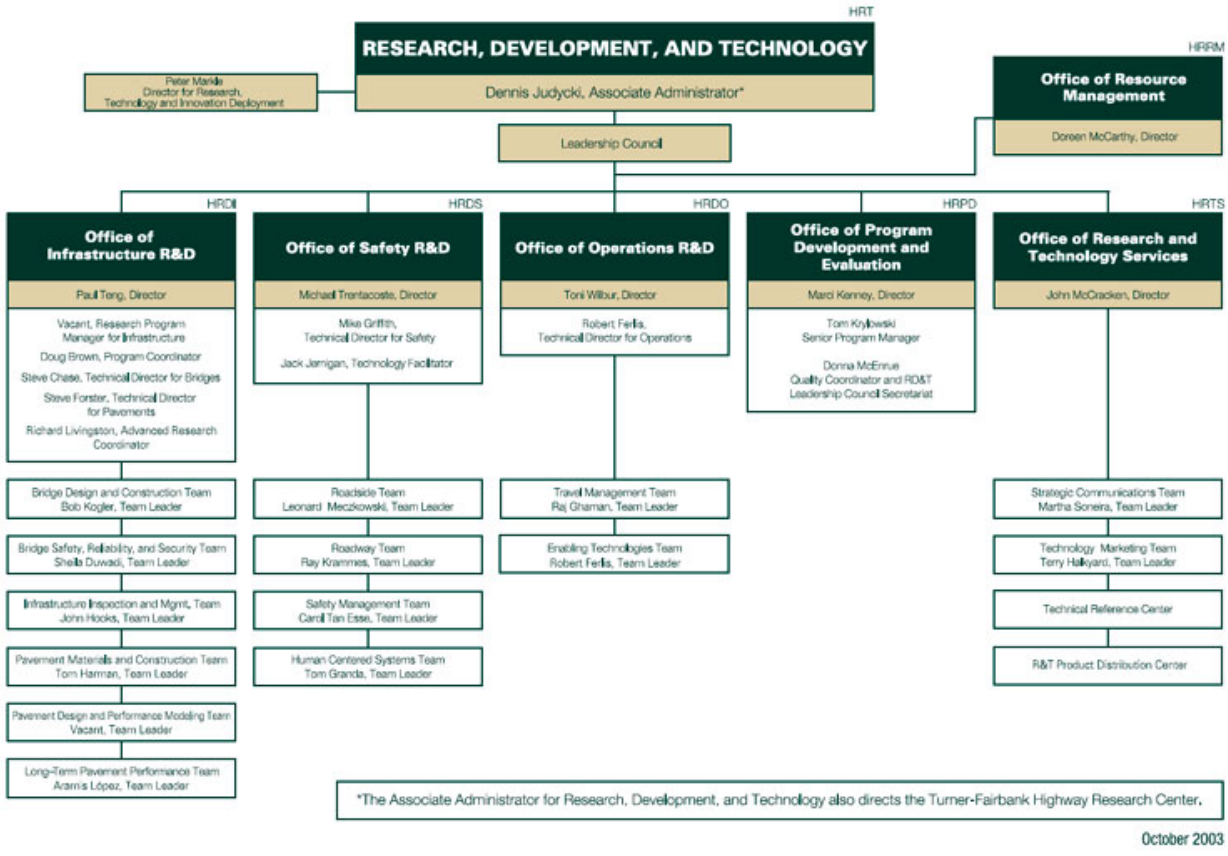
The Office of Operations R&D conducts research to mitigate congestion and improve safety through better management and operation of the surface transportation system. The Travel Management Team produces various hardware and software tools to analyze operational improvements, reduce congestion on surface streets and freeways, and mitigate delays in work zones. The Enabling Technologies Team is developing infrastructure-based systems that will warn motorists of potential intersection collisions; promoting safety by developing decision support tools for winter weather maintenance; and supporting the development and use of safety-enabling technologies such as Dedicated Short-Range Communications and Nationwide Differential Global Positioning Systems (NDGPS).

Safety R&D (HRDS)

The Office of Safety R&D aims to reduce highway crashes and related fatalities and injuries by developing and implementing a program of safety innovations through nationally coordinated R&T. The focus is on FHWA's priority highway safety improvement objectives related to preventing and mitigating

roadway departures, managing safety, improving intersections, and protecting pedestrians. This office provides transportation officials and practitioners with improved understanding, information, and state-of-the-art tools to aid informed decisions on highway safety improvements. The office also conducts advanced research to determine new ways to solve highway safety problems and challenges.

The Federal researchers and staff at TFHRC.



Organization chart.

Program Development and Evaluation (HRPD)

The Office of Program Development and Evaluation (HRPD) champions the research, development, and technology program and those it serves by developing and executing policy, budget, program management, and evaluation tools to further FHWA's R&T program. HRPD also is the focal point for FHWA's participation in cooperative research activities such as the NCHRP and TPF studies, and active outreach to University Transportation Centers (UTC) and the small-business community.

Resource Management (HRRM)

The Office of Resource Management (HRRM) provides critical management support services that contribute to RD&T's research and deployment of T&I activities. HRRM staff provides advice, assistance, and support for financial management of R&T and General Operating Expenses funding, acquisition planning, and contract administration for research programs and research support activities, human resource management and employee development, information technology support for research and business applications, accountable property management, TFHRC facilities management, emergency planning, FHWA continuity of operations support, and physical security.

Research and Technology Services (HRTS)

The Office of Research and Technology Services leads in leveraging T&I deployment, one of the Agency's key business processes. HRTS also provides various marketing and communication services Agency-wide, as well as within RD&T. These include planning and executing the FHWA-wide exhibit program; administering the R&T Products Distribution Center; editing, publishing, and distributing RD&T research reports; overseeing TFHRC Web pages; and publishing periodicals, like Public Roads, that reach customers worldwide. HRTS also supports the implementation of the *Corporate Master Plan for Research and Deployment of Technology & Innovation*.

Director for Research, Technology, and Innovation Deployment

The Director for Research, Technology, and Innovation Deployment provides key support to the Associate Administrator for RD&T in the role of FHWA's champion for R&T. The Director works with FHWA leadership to "e-bar" for research and deployment of T&I and facilitates the development and ongoing implementation of the FHWA *Corporate Master Plan for Research and Deployment of Technology & Innovation*.

RD&T Quality Coordinator/Leadership Council Secretariat

Provides leadership for the quality program within RD&T, which includes coordinating annual Quality Self-Assessment activities. It actively utilizes the RD&T Leadership Council to address quality management initiatives, such as developing and implementing the lab assessment program, and developing and tracking Leadership Council Action Agenda initiatives.

RD&T Leadership Council

The mission of the RD&T Leadership Council is to continuously improve the RD&T organization and its achievement of the FHWA strategic goals. The Council works on a wide range of issues related to the effective management of TFHRC and serves in an advisory capacity to the RD&T Executive Committee (which consists of the Associate Administrator for RD&T, the Director for Research, Technology, and Innovation Deployment, and the RD&T office directors).

Council Goals and Objectives

- Develop priorities for innovative technologies and approaches to R&T.
- Set a research agenda that meets customer requirements.
- Conduct quality research that efficiently and effectively delivers products.
- Deliver high-value work that is relevant to FHWA and USDOT missions.
- Balance effectively the cost, time, and risk of R&T projects managed by RD&T.
- Support dissemination of best practices, solutions, and success stories.

Workgroups Reporting to the Leadership Council:

- Performance Management.
- Customer Survey.
- Information Technology.
- Communications.
- Corporate Focus.

RD&T Leadership Council.

Giving Back to the Community

Fairfax County Fire and Rescue Training

For the past 6 years, firefighters from 2 Fairfax County, VA fire and rescue departments practiced removing pinned and trapped motorists (using crash dummies) from automobile crash tests at the TFHRC Federal Outdoor Impact Lab (FOIL). Normally, these firefighters and rescue workers practice their rescue techniques on junked cars at the Fairfax County Fire and Rescue Academy. However, using crash-test vehicles from the FOIL provides them with a more challenging training exercise, because the FOIL better simulates actual crash conditions. As a result, firefighters who train at the FOIL improve their equipment skills and their rescue techniques in preparation for real-life emergencies.

Preserving the Past

When FHWA's predecessor organization, the Bureau of Public Roads, acquired land in 1940 for a dedicated roadway research facility, it also acquired some local history. The Langley Research Station facility site, which is now TFHRC, wrapped around a private family burial ground, about 0.1 hectare (.25 acre) in size. Lawrence M. Reid, who sold the U.S. Government property rights to the full 235.3 hectares (581 acres), retained property and access rights to the burial site, which dates back to 1855. TFHRC has cared for the site over the years, gathering burial information and developing a plan view of the cemetery and its landscaping. Current restoration efforts used the survey information to build an enclosure fence for the cemetery. Plans include placing a historic marker to describe the significance of the site, and new landscaping will augment the cemetery's historic plantings.

Cemetery at TFHRC

Youth Educational Outreach

Part of the organizational culture at RD&T is an emphasis on societal responsibility, community involvement, and mentorship. RD&T enthusiastically encourages future transportation professionals, and we offer hundreds of students the opportunity to learn firsthand about the role of R&T in the Nation's transportation system, and the wealth of transportation career options. These activities support the educational community at all levels, from research fellow grants to kindergarten through senior high school (K-12) age-appropriate outreach activities. For several years, our research engineers have spoken to and made presentations to local elementary schools to interest students in the engineering profession. RD&T supports other K-12 educational outreach activities include hosting job shadowing on Groundhog Day, Take Your Son/Daughter to Work Day, and the National Engineer Week's Future City Competition, which brings together seventh- and eighth-grade students and engineers to develop models of future cities. FHWA sponsors an award to the Future City team that best incorporates transportation elements in its prototypical design.

Student Volunteer Program

Our efforts to expand the Student Volunteer program at TFHRC focus on establishing partnerships with local universities. The program serves as the basis for encouraging students to obtain practical

experience, conduct meaningful research, and provide a fresh perspective to our highway research program.

Volunteerism

At TFHRC, we give back to the community through a number of other activities. RD&T supports the annual Combined Federal Campaign with a number of creative fundraising and social events, such as the Chili Cook-Off, bake sales, and auctions. Proceeds go to many worthy causes and a special donation is made to the Oklahoma City Scholarship Fund, which benefits the family members of FHWA employees who lost their lives in the Murrah Building tragedy. Throughout the year, employees also collect donations for a Washington, DC, area senior center and sponsor semiannual blood drives to support the American Red Cross of the National Capital Area. Other RD&T public outreach activities include exhibits on the National Mall in Washington, DC, for Public Service Appreciation Week and National Transportation Week.

Facility Tours

TFHRC conducts facility tours, which create awareness among critical audiences and deliver the message that RD&T research provides innovative, real-world solutions to a number of highwayrelated problems. Each year, TFHRC offers tours to hundreds of guests, such as senior legislative and USDOT decisionmakers, congressional staffers, international research colleagues, FHWA State and local partners, and members of professional organizations and associations. Guests visit the labs and learn about research projects that benefit our Nation's transportation system.

Tour group at TFHRC lab.

The Strategic Framework

FHWA's research approach emphasizes cooperation, information sharing, and formal research agenda development.

The FHWA R&T Program Managing

FHWA's R&T program and communicating with our partners are important components of the RD&T mission. FHWA's research approach emphasizes cooperation, information sharing, and formal research agenda development with State and local governments, academia, and the private sector. The RD&T performance plan illustrates RD&T's alignment with the USDOT and FHWA vision, mission, and goals; documents activities that will produce results; and lists the RD&T products and services.

Vision and Mission

FHWA's new vision statement reflects a systemwide approach to improving transportation. Furthermore, the Agency's revised mission statement, "Enhancing Mobility through Innovation, Leadership, and Public Service," affirms that research and innovation are integral to its mission. In fact, one of FHWA's three primary roles is to be "innovators for a better future." This key rewording of the mission reflects R&T's important contribution to enhancing mobility, and it underscores FHWA's commitment to organizationally "raise-the-bar" on research and deployment of T&I.

DOT Vision (FY 2003) Safer, simpler, smarter transportation solutions.	FHWA Vision Improving transportation for a strong America.	RD&T Vision An RD&T organization that is essential, indispensable, and connected to our partners in advancing R&T.
DOT Mission (FY 2003) Develop and administer policies and programs that contribute to providing fast, safe, efficient, and convenient transportation at the lowest cost consistent with the national objectives of general welfare, economic growth and stability, the security of the United States, and the efficient use and conservation of the resources of the United States.	FHWA Mission Enhancing mobility through innovation, leadership, and public service.	RD&T Mission Leads in developing a nationally coordinated research and technology program; champions the advancement of highway technological innovation in support of FHWA strategic goals and performance objectives; advances knowledge through research, development, testing, and evaluation services; and provides support and assistance throughout FHWA in matters relating to RD&T.

FHWA Goals and Objectives for FY 2003

Safety

- Reduce fatalities involving roadway departure (run-off-theroad and head-on) crashes.
- Reduce intersection-related fatalities.
- Reduce pedestrian-related fatalities.
- Support national safety strategies, including an increase in use of seat belts.

Mobility and Productivity

- Further deploy ITS infrastructure and sustain improvements to system operating practices.
- Mitigate overall impacts of congestion through effective local partnerships.
- Reduce work zone delay by ensuring that all States, the District of Columbia, Puerto Rico, and Federal Lands offices are engaged in aggressively anticipating and mitigating congestion caused by highway work zones.
- Reduce traffic incident delay by ensuring that all States, the District of Columbia, Puerto Rico, and Federal Lands offices are engaged in aggressively anticipating and mitigating congestion caused by traffic incidents.
- Improve and expand the National Highway System to increase system efficiency and return on investment.

Environment

- Provide training and technical assistance to our partners to minimize the potential adverse environmental impacts of Federal-aid and Federal Lands projects.
- Enhance knowledge of FHWA staff in ecosystem and habitat conservation, and showcase existing exemplary initiatives.
- Reduce on-road mobile source emissions.

National Security

- Identify critical highway infrastructure, evaluate its risk and vulnerability, and develop measures to reduce vulnerability.
- Ensure preparedness for response to, and recovery from, malevolent attacks on highway infrastructure.
- Facilitate military deployment from forts to ports.
- Initiate research, technology development, and deployment activities in support of a more secure highway system.

Organizational Excellence

- Provide stewardship of funds and coordinate efforts to ensure that our partners maintain good accountability for expenditures.
- Establish timeframes for all current projects requiring Environmental Impact Statements (EIS) or Environmental Assessments (EA); continue to reduce the environmental processing time for all EIS and EA projects.
- Develop and implement the FHWA Human Capital Plan and the Restructuring Assessment Task Force recommendations for Professional Development and Training.
- Establish, implement, and monitor a system of customer surveys and Agency response to the feedback to improve customer service and satisfaction.

- Lead and coordinate efforts to effectively perform the role of Innovators for a Better Future, and increase the effectiveness of all FHWA units, as well as of our partners and stakeholders, in determining priorities and deploying T&Is.

FHWA "Vital Few"

The Agency's focus on Safety, Congestion Mitigation, and Environmental Stewardship and Streamlining reflect FHWA's desire to commit resources in areas where critical performance gaps exist and where the greatest impact can be made.

Performance in these areas will define success for our Agency and affirm the need for a Federal role in highway transportation.

FHWA Roles

Based on extensive discussions, in 2001 the FHWA Leadership Team developed three role statements that affirm FHWA's new mission and declare our identity. In support of the Agency roles, TFHRC commits to:

- Coordinating R&D with and for our stakeholders and partners.
- Supporting an environment that encourages innovation deployment.
- Creating improved technology and innovation deployment processes.

As innovators for a better future, TFHRC provides FHWA, its stakeholders, and customers—the world highway community—with the most advanced R&D related to new highway technologies —focusing on solutions to complex technical problems by developing economical, environmentally sensitive designs; efficient, quality-controlled construction practices; and durable materials, all of which will create a safer, more reliable highway transportation system.

RD&T Corporate Missions and Functions

RD&T performs several key functions to champion the advancement of highway technological innovation throughout FHWA. The following examples illustrate some of RD&T's unique functions in support of the Agency's role as "innovators for a better future."

Highway Research and Development

- Research and innovation.
- Technical assistance.
- Forensic evaluation.
- Management of FHWA Highway Research Center.

Implementation of the Corporate Master Plan

- Support of FHWA R&T Leadership Team in the implementation of the Corporate Master Plan for Research and Deployment of Technology & Innovation.
- Champion for Corporate R&T.

Strategic Planning and Budget

- R&T budget formulation and execution.
- Legislative monitoring and analysis of R&T issues.
- R&T performance measurement framework development.
- Agency input into USDOT RD&T Plan.

Outreach, Communication, and Consultation

- Research liaison and partnership activities.
- R&T marketing.
- Publishing and promoting FHWA R&T information.
- TFHRC visits/tours.

The Corporate Master Plan for Research and Deployment of Technology & Innovation

FHWA developed an Agency-wide plan for R&T, the Corporate Master Plan (CMP) for Research and Deployment of Technology & Innovation. The CMP recognizes that R&T is an Agency-wide program, involving headquarters program offices, RD&T, and FHWA field offices. The CMP continues to expand the effectiveness and efficiency of R&T, with special emphasis on deploying and implementing technologies and innovations to improve the quality, cost-effectiveness, and timeliness of products, procedures, processes, practices, and/or techniques. It sets out a role, new focus, and guiding principles for the FHWA R&T program to improve highway transportation, and outlines FHWA's corporate strategy for investing in and conducting cooperative research with partners and stakeholders. In implementing this plan, the Agency is committed to engaging stakeholders throughout the R&T process and effectively communicating the R&T program, which includes publishing an Agency-wide R&T performance report. The CMP elaborates 26 agency commitments to address the 7 guiding principles. It is available on the FHWA Web site at: https://www.fhwa.dot.gov/legsregs/directives/policy/cmp/03077.htm.

Corporate R&T Focus

In the FHWA FY 2004 Performance Plan, the Agency is committed to evaluating the effectiveness of R&T. Under the CMP, the Agency has committed to developing, defining, and adopting a framework for measuring performance. The framework will align with strategic and performance plans, and allow FHWA to evaluate R&T at the Agency, program, and project levels.

Guiding Principles for FHWA's Corporate Role in R&T

1. The FHWA R&T process, from research through implementation, is systematic and begins with the end in mind.
2. FHWA engages in advanced and applied research and innovation deployment activities where there is an appropriate Federal role.
3. Stakeholders are engaged throughout the R&T process.
4. The R&T process is grounded in the FHWA mission and goals and guided by multiyear plans.
5. The R&T budget allocation is based on and driven by multiyear plans and priorities.
6. FHWA measures the performance of R&T on the Agency, program, and project levels.
7. FHWA effectively communicates its R&T program and projects.

R&T Leadership Team

To ensure a corporate approach to R&T and to implement the CMP, the FHWA has formed an R&T Leadership Team consisting of Associate Administrators for Environment and Planning, Federal Lands, Infrastructure, Operations, Policy, Professional Development, Safety, and RD&T; the Directors of Field Services; and a Division Administrator's Council member. The Associate Administrator for RD&T has a key role on the R&T Leadership Team as champion for the FHWA R&T program and for facilitating and supporting the Leadership Team in implementing the CMP.

Our Business Results

RD&T Challenges, Commitments, and Achievements

To guide our business and performance plan, the RD&T Leadership Council's vision is to conduct research and provide products and services that are essential, indispensable, and connected to our customers and partners. We are committed to continuing our quality journey (the process that FHWA uses to regularly assess its management practices); initiating program, process, and quality-of-work-life improvements; conducting outstanding research; and providing services that exceed performance indicators, strategic goals, and customer and partner expectations. The following are our top challenges and some key achievements related to fulfilling them:

Effectively Deliver Needed Products and Services

1. Develop quality research products and services that address the needs of our internal customers and external partners in a timely manner.
    - RD&T customer surveys provide our staff with valuable feedback on our research, which spans many disciplines and transportation topics, from highway design, engineering, and maintenance to economic analysis, human factors, travel surveys, outreach, and marketing. The project and services tables in appendices A and B provide status reports on RD&T research projects, and list the various services provided over the past year to our customers and partners. RD&T also makes the results of its research available through the TFHRC Web site, the RD&T performance report, the Transportation Research Information Service, American Association of State Highway and Transportation Officials (AASHTO) committees, and presentations at the Transportation Research Board's (TRB) Annual Meeting.
    - The re-engineering of the Transportation Pooled Fund(TPF) Program was completed with the launch of a new, interactive TPF Web site in 2003. The site enables online solicitations and funding commitments for new pooled fund studies, and allows lead agencies to post work plans, progress reports, final report/deliverables, implementation activities, and other relevant information. HRPD conducted mini-workshops on the TPF program during the summer at each of the AASHTO Research Advisory Committee (RAC) regional meetings.
    - HRDI researchers played a key role in developing a major new initiative for FHWA called "Highways for LIFE." This Administration initiative seeks to advance the state-of-the-practice in highway construction by demonstrating and promoting the adoption and use of the best available technologies and contracting practices. LIFE is an acronym for Long-lasting highways using Innovative technologies and practices to accomplish Fast construction of Efficient and safe pavements and bridges. LIFE's goals will be achieved through: demonstration projects built under high standards for quality and performance; an extensive program of technology transfer (T2), education, and evaluation; and industry

partnerships to encourage more extensive integration of beneficial technologies in highway construction equipment, materials, processes, and practices. We have developed a lab assessment process that will allow routine expert peer review of the research conducted at TFHRC.

- A ribbon-cutting ceremony was conducted at the TFHRC Accelerated Loading Facility in December 2002 to commemorate the completion of 12 full-scale hot-mix asphalt (HMA) test lanes that were constructed as part of a pooled fund study. The lanes will be used to test polymer-modified asphalt binders, with the goal of developing new Superpave® specifications that cover both polymer-modified binders and unmodified binders. The ribbon cutting was attended by members of the pooled fund study State panel, TFHRC's Asphalt Team, FHWA Associate Administrator for RD&T Dennis Judycki, Office of Infrastructure R&D Director Paul Teng, and representatives from the asphalt industry, which contributed the asphalt for the test sections.

2. Improve R&T collaboration and communication with the FHWA Resource Center and Division Offices. [Note: The FHWA Division Offices and Resource Center provide a direct link to our external customers and stakeholders for the delivery of T&I. As a result of the FHWA restructuring assessment, the four Resource Centers have been combined into a single Resource Center with the enhanced capability to provide training and technical assistance across national and geographic boundaries.
    - HRTS completed its evaluation of the Technology Facilitation Action Plan (TFAP) process and developed recommendations to improve product development and delivery of research results for RD&T. TFAPs involve FHWA Program Offices, Division Offices, and the Resource Center in planning R&T delivery and implementation at the start of the research process.
    - On October 22 and 23, 2002, the Director for Research, Technology, and Innovation Deployment and his staff met with 35 internal and external FHWA stakeholders in Washington, DC, to generate ideas for improving Agency processes for research and deployment of T&I. Outreach sessions included Program Administrators, Directors of Field Services, and a Division Administrator's representative. This session laid the groundwork for developing the Corporate Master Plan for Research and Deployment of Technology & Innovation, published in April 2003.
    - RD&T managers and staff participated in a series of alignment meetings with the Directors of Field Services to help ensure that the divisions' workplans were aligned with Agency goals and objectives.
    - RD&T staff were engaged in several Agency-level discussion groups and forums involving headquarters, Division Offices, and the Resource Center throughout the year, on topics such as Division Key Processes, the Agency Vital Few goals, performance planning, and performance measures. RD&T staff also participated in videoconferences with the Division Offices to discuss the research provisions in the Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003 (SAFETEA), and to discuss the Highways for LIFE initiative. These meetings leveraged state-of-the-art Web conferencing technology to provide an opportunity for practitioners to share insights, experiences, and best practices in the interest of improving organizational processes.
    - The RD&T Customer Survey Workgroup evaluated existing methods used for customer feedback in RD&T and assessed the need for surveys geared toward specific segments of the RD&T customer base. In addition, activities involving stakeholders were documented and made available. The group is currently working with the FHWA Office of Acquisition Management (HAAM) to test a Web-based survey it has developed that focuses on customer satisfaction with RD&T products.

3. Implement and refine the lab assessment process to provide regular, independent feedback to improve the quality of lab services and lab-based research programs.
    - A pilot lab assessment was conducted in the Office of Safety R&D's Human Centered Systems Lab at TFHRC, April 28–May 1, 2003. The assessment was the first conducted in accordance with recently developed procedures for the periodic and routine assessment of all lab research and programs at TFHRC by external panels of experts. The process was modeled in part on the National Academies' National Institute of Standards and Technology (NIST) review process and the State DOT peer-exchange program. The objective of the assessment was to provide independent feedback to lab managers, FHWA leadership, and partners to improve the quality of lab research and services. The assessment panel included representatives from academia, government, and industry. RD&T is committed to beginning a regular schedule of lab assessments; the next assessment will focus on the Asphalt Pavement Lab.
4. Effectively use research resources and ensure efficient RD&T facility, organization, and program operations.
    - In November 2002, the Agency presented RD&T with the Quality Breakthrough Award. This Level II Quality Award recognizes organizations making significant progress in developing clear plans, building sound processes, and achieving measurable results in meeting the goal of providing a total quality environment. The Associate Administrator for RD&T presented highlights and lessons learned from RD&T's Quality Journey at FHWA's National Quality Conference in August 2003.
    - Due to changes in security requirements for the TFHRC facility, key card readers and guards were added to the facility entrances, exterior security cameras were mounted, and a public address system was installed. A vulnerability study of the facility was conducted and a report received.
5. Define and implement methodologies/tools to evaluate projects and conduct performance measurement of TFHRC research.
    - R&D office projects were logged into the Shared Unit Performance Plan System, and project status reports were submitted to HRPD for use in the annual RD&T performance report.
    - HRDI completed a study that examined the benefits of Infrastructure R&D completed over the past 20 years in the areas of national design and data standards, new technologies, and new materials development. The guiding principle in developing the performance measures and assessment framework was to ensure that the measures are relevant, capture all types of research activities, are objective enough to highlight the benefits and weaknesses of research programs and projects, and above all, are simple enough to be easily understood and applied by program managers. A synthesis comparing lessons learned from the study with those learned from other recent studies will be developed. A brief summary of the studies is provided in section IV of this report.
    - FHWA RD&T staff are founding members of the Washington Research Evaluation Network, an interagency group that meets periodically to share best practices regarding research program operations and to review issues relating to the President's Management Agenda.
    - RD&T staff supported the Office of the Secretary of Transportation (OST) and the interagency working group advising the Office of Science and Technology Policy and the Office of Management and Budget (OMB) on the development and implementation of the criteria for Federal investment in R&D. In a related effort, RD&T staff worked with the interagency group to modify the OMB's Program Assessment Rating Tool (PART) for R&D to reflect the new criteria.

6. Advance information technologies and systems to address the unique needs of a world-class research organization.
    - RD&T provided data to the FHWA Enterprise Architecture Initiative. The data defined business processes, subprocesses, inputs, outputs and supporting systems, and identified areas for improvement.
    - The Information Technology (IT) Workgroup gathered requirements for the new IT support contract statement of work (SOW). In developing the SOW, the group looked at the changing requirements for IT services in the future. It was determined that longer help desk hours were needed and that the flexibility provided by a task order-type contract would provide the best means to adapt to changing research requirements.

Develop and Recognize Employees

7. Mentor, encourage, and build employee skills and add to FHWA research capacities and competencies.
    - RD&T employees benefited from tuition reimbursement programs and were active participants in other professional development programs and activities. Joseph Hartmann, a Research Structural Engineer for HRDI, was selected to participate in the Academic Study Program for 2003–2004.
    - RD&T hosted more than 15 participants of Federal leadership development programs, including the Executive Potential Program and the Executive Leadership Program.The programs are geared to developing and equipping participants with the skills necessary to strengthen individual and organizational performance. Hosting the participants provided RD&T staff with an opportunity to mentor and serve as role models for future Federal executives and managers.
    - HRDO supported FHWA's Professional Development Program (PDP) by hosting a PDP participant who was eventually hired as a permanent employee at the end of the assignment. The PDP is a formal 24-month development program in which the PDP participant is assigned to a sponsoring office.
    - HRPD hosted 2 student interns for 10 weeks this summer, one from Texas Southern University, the other from the University of Wisconsin, as part of STIPDG.
    - Three new employees joined the organization in FY 2003, helping to broaden RD&T research capabilities and competencies.
    - An International Research Fellow from the Japanese Ministry of Land, Infrastructure, and Transport joined Operations R&D in May on a 1-year fellowship sponsored by the United States-Japan ITS Joint Research Program.
8. Improve the award and recognition program to value achievements, link directly to team accomplishments, and advance the RD&T Leadership Council Action Agenda.
    - An RD&T Employee Recognition Committee was organized to improve methods for recognizing RD&T employees whose efforts have resulted in superior achievement. These awards provide TFHRC-wide recognition to deserving employees for their contributions to RD&T. Nominations for the awards will be solicited annually and are open to all RD&T Federal employees or teams. All nominations will be screened and evaluated by an Awards Review Team. Finalists will be selected by the RD&T Executive Committee.
    - RD&T staff were selected to receive the USDOT Secretary's Award and the Administrator's Award for their outstanding achievements during FY 2003. Honorees for the Secretary's award were:
        - Jean S. Landolt, Secretary, Office of the Associate Administrator for RD&T.
        - Leonard Meczkowski, Highway Safety Specialist, Office of Safety R&D.
    - Honorees for the Administrator's Award were:

        - Peter C. Markle, Director for Research, Technology, and Innovation Deployment.
        - Sheila R. Duwadi, Research Structural Engineer, Office of Infrastructure R&D.
        - Raymond A. Krammes, Research Highway Engineer, Office of Safety R&D.
        - Cheryl A. Richter, Research Highway Engineer, Office of Infrastructure R&D.
    - The Secretary's Team Award went to the FHWA Infrastructure Research and Technology Working Group. RD&T members were:
        - Steven B. Chase, Technical Director for Bridges, Office of Infrastructure R&D.
        - Charles J. Churilla, Research Program Manager for Infrastructure, Office of Infrastructure R&D.
        - Stephen W. Forster, Technical Director for Pavements, Office of Infrastructure R&D.
        - John M. Hooks, Infrastructure Inspection and Management Team Leader, Office of Infrastructure R&D.
    - Raymond A. Krammes, Research Highway Engineer, Office of Safety R&D, was selected as FHWA Engineer of the Year. His contributions to the Interactive Highway Safety Design Model (IHSDM) were invaluable; IHSDM is a key component of FHWA's plan to improve highway safety. Raymond's application will be sent to the National Society of Professional Engineers (NSPE) for consideration for the Federal Engineer of the Year Award.

Communicate the FHWA R&T Story and Future Agenda

9. Improve the state of FHWA R&T initiatives and focus areas.
    - The Corporate Master Plan for Research and Deployment of Technology & Innovation was finalized and published this year. The CMP was provided throughout FHWA and to external stakeholders. Several key stakeholders were briefed, and it was well received both internally and externally. Along with publication of the plan, the formal organization and recognition of the FHWA R&T Leadership Team was accomplished. The team will have primary responsibility for implementing the CMP. The CMP is posted on FHWA's public Web site at: https://www.fhwa.dot.gov/legsregs/directives/ policy/cmp/03077.htm.
10. Collaborate with FHWA headquarters and field offices to gather and disseminate achievements in FHWA T&I delivery.
    - RD&T staff participated in a working group with FHWA headquarters and field office representatives to identify priority market-ready T&Is warranting special attention. The technologies are ones that: support agency priorities, including strategic goals; indicate strong user need and likelihood of implementation; are developed to the point of being truly market ready (with a tool(s) available); and have expertise available to support deployment and implementation. The products identified were not intended to include all T&Is available. Numerous T&Is are being developed that are considered good concepts, practices, and/or success stories that should continue to be shared, but are not yet ready to be marketed in the field. The list, which was approved by the Agency R&T Leadership Team, incorporates the nine technologies recommended by the AASHTO Technology Implementation Group (TIG). See appendix C for the complete list.
    - HRTS compiled the second annual report on T2 activities; it tracks funds spent on technology deployment and assessment functions, and includes cost data from all the FHWA program offices, the Resource Center, Federal-aid Division Offices, and Federal Lands Divisions involved in T&I delivery. The information is

grouped by strategic goal and broken down into five categories related to the method used for delivering the new technology or innovative practice: 1) training; 2) showcase projects; 3) specifications, design guides, and other tools; 4) test and evaluation projects; and 5) general communications and outreach.

- RD&T develops and executes a comprehensive research, development, and technology communications strategy and plan that disseminates achievements in FHWA T&I delivery. In FY 2003: more than 100 reports, informational publications, and newsletters were produced; 115 exhibits were shipped and stored; more than 8,000 publications were mailed from the R&T Product Distribution Center; and more than 24 Agency-level conferences and meetings were supported with logistics, communications, and marketing services. These activities supported the FHWA-wide R&T program and the technology delivery needs of FHWA field and headquarters offices, the Resource Center, and thousands of FHWA customers nationally and abroad.

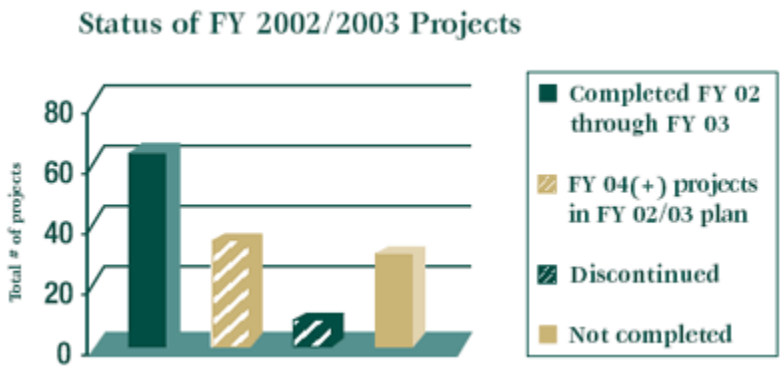
11. Identify national research program priorities, resources, and funding needs with our partners.
    - RD&T leadership met with the TRB R&T Coordinating Committee at a symposium on highway R&T held April 3–4, 2003, in Washington, DC. The symposium elicited stakeholder views on how well highway transportation R&T programs conducted by the Federal Government are addressing the full range of national R&T priorities.
    - Symposium participants included a wide range of highway R&T stakeholders as well as several congressional committee staff members responsible for drafting material to be considered by Congress as it prepares to reauthorize the surface transportation legislation that determines Federal support for highway R&T.
    - A surface transportation reauthorization Web site was established for reauthorization outreach; it allows the public to make comments directly into the docket. The Web site is: https://www.fhwa.dot.gov/reauthorization/index.htm.
    - RD&T participated in four regional RAC meetings this summer. Topics included: promoting research results, improving tech transfer, and measuring performance. In addition, training was provided for State DOT managers on the use of the improved TPF program Web site.
    - RD&T coordinated and developed the FHWA portion of the USDOT RD&T Plan, highlighting key technologies supporting departmental goals. The USDOT RD&T Plan, which was mandated under the Transportation Equity Act for the 21st Century (TEA-21), has been praised by the Government Accounting Office as a model for government R&D planning. The plan facilitates the coordination of research between the various modes within the USDOT and supports the budget and program development process. Technologies highlighted include human performance issues affecting safety; new technologies to improve operator performance; countermeasures for transportation-related incidents; integrated transportation security assurance measures; advanced materials and design concepts; and computeraided planning and design tools.
    - The Future Strategic Highway Research Program Oversight Panel met in December 2002 and in May 2003, to review the proposed work plans for the program's four research areas. A summary report of the four research plans has been prepared, as well as various outreach materials. FHWA liaisons to the four panels helped ensure that the research plans complemented, rather than duplicated, research being done by FHWA or that may be done under the proposed Surface Transportation Environment and Planning Cooperative Research Program.
12. Build a common advocacy to enhance the national R&T program and legislative agenda.
    - On May 14, 2003, Transportation Secretary Norman Y. Mineta unveiled the Bush Administration's 6-year, $247 billion surface transportation reauthorization proposal, SAFETEA. Changes included in SAFETEA are intended to strengthen surface transportation research, facilitate partnerships for research and

implementation, and improve technology deployment. The overall program level for surface transportation research and deployment increases by onethird, including a new safety innovation deployment program, exploratory advanced research, a cooperative environment and planning research program, and restructured program activities for pavement and bridges/structures. RD&T staff provided briefings and informational material for FHWA field offices and the Agency's research partners and stakeholders. As a result, partners and stakeholders were better informed on the provisions and changes included in SAFETEA that are intended to strengthen surface transportation research, facilitate partnerships for research and implementation, and improve technology deployment.

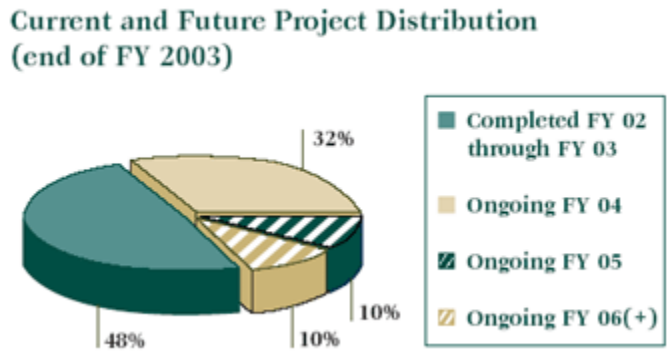
- RD&T provided a number of informational briefs for U.S. Congressional staff and responded to requests for technical assistance by members of Congress and their staff several times throughout the year. In addition, the Senate Committee on Environment and Public Works staff visited TFHRC in August 2003 for a briefing and tour of the facility.
- Deputy Administrator J. Richard Capka testified on reauthorization of the Transportation Research, Development, and Education Programs before the U.S. House Committee on Transportation and Infrastructure on March 4, 2003.
- Emil Frankel, Assistant Secretary for Transportation Policy, and Dennis Judycki, the FHWA Associate Administrator for Research, Development, and Technology, testified on reauthorization of the Transportation Research, Development, and Education Programs before the U.S. House Science Subcommittee on Environment, Technology, and Standards on April 10, 2003.
- AASHTO, TRB, and numerous other organizations also testified before these committees in support of a strong FHWA role in R&T.

Research Project Status Summary

Of the 83 projects listed in the FY 2002/2003 Performance Plan that were slated for completion by FY 2003, 60 were completed. In 2002, 37 were completed, and 23 were completed in 2003. Of all the projects listed in the plan, 24 were scheduled for completion in FY 2004 or beyond, and 9 were discontinued or redirected as new knowledge, procedures, and technologies changed the state-of-practice within their respective disciplines. A total of 23 projects listed in the FY 2002/2003 Performance Plan were not completed and were rescheduled. In addition, 12 projects were initiated and completed within FY 2002/2003 that were not in the original plan. These projects reflected new developments and opportunities to partner with other researchers. There are 75 projects that are still ongoing for FY 2004 and beyond that will be included in the FY 2004/2005 Performance Plan. Details regarding specific RD&T projects and services are available in the research project status and services tables located in appendices A and B.



Status of FY 2002/2003 Projects.



Current and Future Project Distribution (end of FY 2003)

RD&T Success Stories

RD&T successfully completed and delivered projects during FY 2002 and 2003 to support USDOT's strategic goals and FHWA's performance goals. The following highlights showcase research implemented by FHWA and State DOTs.

Infrastructure

- New Bridge Specifications
  At the annual meeting of the AASHTO Subcommittee on Bridges and Structures, June 1–6, 2003, a major rewrite of the Load and Resistance Factor Design (LRFD) steel bridge design code was adopted for implementation in the third edition of the specifications. This is a major victory for FHWA's curved girder bridge research initiative underway in the Structures Lab. Based on data developed by FHWA and a thorough review of the literature, new equations were developed that represent a major step to unify the design of straight and curved girder bridges into one specification. Currently, the new equations are only adopted for straight girders, but they are developed to handle curved girder design in the near future. The current plan is to present modifications to fully incorporate curved girders at the 2004 AASHTO meeting. The ongoing composite bridge test has been designed to provide key data for the 2004 code revisions.

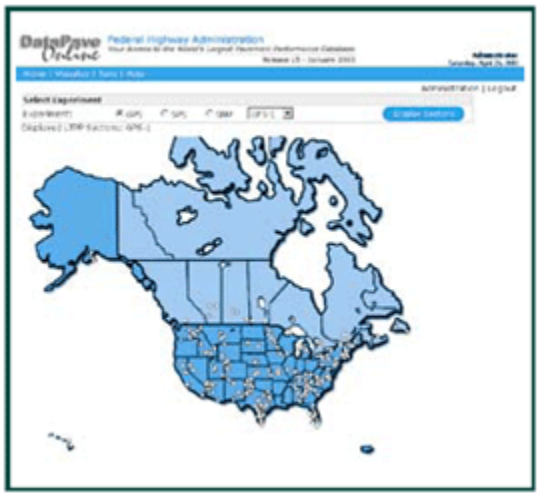
FHWA played a key role in developing the new specifications. Researchers working under a task order to the Structures Lab support contract authored the new code provisions. The FHWA project produced much of the supporting data, including both full-scale lab tests and computer-generated data using finite element analysis. Extensive peer review of the process was provided through numerous meetings of an expert working group hosted by FHWA and the American Iron and Steel Institute. The effort was fully coordinated with researchers working to develop an LRFD curved girder specification under NCHRP project 12-52.

The new specifications offer several significant advantages compared to existing ones. The entire steel bridge design process has been simplified while providing a more consistent level of reliability for steel bridges. More important, the foundation has been laid to fully integrate straight and curved girder bridge design. The current process requires designers to work back and forth between different specifications. The payoff is that the new specification should improve the efficiency of steel bridge design, resulting in lower cost and probability of error in the process. The research, ranked as the top priority of the AASHTO Highway Subcommittee on Bridges and Structures, is an essential step to support the AASHTO and FHWA goal to have all States using the LRFD design code for all Federal-aid bridges by 2007.

- Physical Properties of Ultrahigh-Performance Concrete (UHPC)
  Reactive powder concrete (RPC) has been introduced as a structural material for highway bridges. The material consists of a finely graded cement paste with embedded steel fibers measuring approximately 0.2 millimeters (mm) in diameter and 12 mm in length. RPC has very high strength, stiffness, and toughness. The elastic properties of this new material depend on proper casting and curing of the concrete. Researchers at TFHRC have developed a new, nondestructive method of determining the elastic properties. The technique uses acoustic waves to determine the modulus of elasticity for the material, and is being developed as a quality control tool for future construction using RPC. The acoustic method correlates well with conventional destructive methods of determining the modulus of elasticity. The new technology will provide a cost-effective tool for evaluating the quality of UHPC in the field. Acoustic techniques for the detection of deterioration and cracking of this new material have also been developed that will assist in the condition assessment of UHPC structure in the future.
- Commercial Test Kits for Quantifying Chloride on Steel Surfaces
  FHWA published the “Assessment of Commercial Test Kits for Quantifying Chloride on Steel Surfaces” in the August 2003 issue of the Journal of Protective Coatings and Linings. This paper provides a comprehensive comparison of three different commercial chloride test kits and points out the strengths and weaknesses of each. FHWA investigated and compared the efficiency of the swab, patch, and sleeve test kits for extracting chloride contaminated steel surfaces at four different chloride levels. It was found that the efficiency decreases significantly after the steel surface was exposed at 37 °C and 78 percent relative humidity for 4 hours; therefore, it is highly recommended that chloride tests should be conducted as soon as possible after the sand blasting of steel surfaces. The guidelines and recommendations for performing chloride extractions efficiently and accurately in the field were given in this publication; they will help government agencies, States, and industry groups to obtain more accurate chloride concentrations on steel surfaces prior to paint applications. Accuracy of chloride determination is critical to the performance of coatings on steel surfaces of highway bridges. This journal paper is widely distributed and considered as the most comprehensive study of the current chloride test kits. For further information, please contact Dr. Shuang-Ling Chong at shuang-ling.chong@fhwa.dot.gov.
- Superpave
  The United States invests more than $15 billion in each year to construct and resurface roads with HMA. This annual investment requires at least 500 million tons of HMA, held together by about 30 million tons of liquid asphalt binder. The Superpave system, developed under the Strategic Highway Research Program (SHRP), is the primary mechanism used by State highway agencies to purchase liquid asphalt binder and design asphalt mixtures. In close partnership with TRB, FHWA continues its leadership role in refining the Superpave specifications and testing procedures. Recent innovations include modifying the low-temperature binder specification and incorporating an FHWA-developed device to increase lab mixture compaction uniformity in the gyratory.

ALF

- HIPERPAV
  Originally developed in 1996, the High-Performance Paving Software (HIPERPAV) is a powerful tool that helps highway organizations build long-lasting concrete pavements. When used in the design and construction phases of a concrete paving project, HIPERPAV can help engineers achieve a highquality product at minimal cost by optimizing pavement and overlay design, optimizing mix design and temperature characteristics, and reducing long-term performance uncertainties. HIPERPAV II expands the modeling capabilities to consider early-age behavior of continuously reinforced concrete pavements (CRCP) and longer-term behavior of jointed concrete pavements (JCP), in addition to the early-age JCP and bonded concrete overlay capabilities provided in early versions.
- Construction Quality Assurance Manual
  This manual, the product of a State planning and research pooled fund study, is a comprehensive guide for State highway agencies that wish to develop new, or modify existing, acceptance plans and quality assurance specifications. It provides necessary instructions and illustrative examples to lead the agency through the entire process of acceptance plan development, which includes three phases—initiation and planning, specification development, and implementation. The manual is centered around a flowchart presenting the steps in each of the three phases, with the text containing a detailed discussion for each step. Through the use of proper, well-established analytical tools described in the manual, effective quality control and acceptance procedures can be incorporated into quality assurance specifications that are fair to both the contractor and the highway agency.
- DataPave Online
  DataPave was designed by the Long-Term Pavement Performance (LTPP) program to reach out and provide the global highway community with the most up-to-date data available from this 20-year study of in-service pavements. On January 17, 2003, the LTPP products team launched the next generation of this software online. Since then, the Web site has evolved into one of the greatest success stories in 2003 for the LTPP program, supplying more than 500 users with more than 3.14 GB of information in a steadily increasing number of data exports (4,191 to date). The number of registered users has grown to include many from Argentina, Australia, Brazil, Canada, Chile, Denmark, England, Finland, France, Greece, Hong Kong, Hungary, Iran, Italy, Japan, Korea, Netherlands, New Zealand, Portugal, Singapore, Spain, Turkey, Zimbabwe, and other countries. This product has shown the importance of providing our customers with an easy way to obtain LTPP data.



Screenshot of DataPave online

- New LTPP Falling Weight Deflectometer (FWD) Calibration Center in Colorado
  LTPP, in conjunction with the Colorado DOT, established a new FWD calibration center in Denver, CO. The new center replaces the previous Reno, NV, facility and will serve the LTPP Program's Western Region. The move from Reno was triggered by what the Nevada DOT considered to be an overburden in staffing requirements for the calibration center. Understanding the need for these centers, and the benefit of convenience in location, the Colorado DOT offered to host the new facility.

  The LTPP calibration centers are supported jointly by the FHWA LTPP program and the host State highway agencies. LTPP provides the equipment, procedures, protocols, and technical support, while the States supply the facilities and staff. The FWD calibration centers provide a vital service to the transportation community, ensuring that FWD owners and operators have a place to keep their equipment properly calibrated. Calibration on a regular basis gives the FWD owners and operators the best possible assurance that they are collecting reliable data.

  Several visits were made to the Colorado DOT to evaluate the structural and spatial adequacy of the facility to meet the requirements of FWD calibration. Testing was performed on the concrete test slab, electrical source, temperature control, and ventilation. These tests indicated that some modifications were needed, including improving the ground in the source circuit to reduce electrical noise; sawing the concrete test slab to isolate vibration to the surroundings; and working with the users of an adjacent garage bay to allow more space for maneuvering equipment. Training visits were also made to ensure that the new staff was comfortable with the calibration procedures.
- Partnering To Save Time and Money on a Critical Infrastructure Project
  During the foundation construction for the new Woodrow Wilson Bridge in Washington, DC, a tremie concrete seal dislodged from one of the main piers and fell to the bottom of the Potomac River. Although this had no immediate effect on the structural stability or integrity of the main pier (the tremie concrete enabled dewatering for construction of the pier cap), there was concern about the long-term scour effects of the thicker tremie seal that was originally proposed as a solution to the problem. The Maryland Division Office, the FHWA Resource Center, and FHWA's Hydraulics Lab provided technical assistance to the Maryland State Highway Administration. FHWA tested physical models of the new pier configuration in the flume at TFHRC to estimate the long-term scour effects. The tests confirmed that bridge safety was not affected by the change, and this major project continued on schedule.

- Report Estimates Cost of Corrosion in the United States
  FHWA published the Corrosion Cost and Preventive Strategies in the United States, a report that provides a comprehensive and current estimate of the total economic effect of metallic corrosion in the United States and identifies national strategies to minimize the impact of corrosion. Corrosion's total direct cost is estimated at $276 billion per year. FHWA analyzed the effects of corrosion in 26 industrial sectors and extrapolated these results for a nationwide cost estimate. Sectors were divided into five major categories: infrastructure, utilities, transportation, production and manufacturing, and government. The conservative estimate of the indirect cost is equal to the direct cost of corrosion. The report is widely referenced as the most authoritative, comprehensive, and current study of corrosion cost in the United States. Further information is available at http://www.corrosioncost.com.
- Serving Internal Customers: The Office of Infrastructure R&D Delivers a New Tool to FHWA Bridge Engineers
  This project developed a Web-based system to access the National Bridge Inventory (NBI), with search and analysis capabilities that enable FHWA bridge engineers to better understand the relationship between bridges, bridge conditions and capacities, and bridge performance in the national transportation system. Web-NBI is the Web-based NBI system that engineers may use to access and analyze NBI data.

  Its functionality includes:
  - Ability to download NBI files in Microsoft® Access or ASCII text format for any State.
  - Ability to create dynamic queries, browse the results, and download the results.
  - Ability to perform dynamic cross-tab queries and browse the results.
  - Ability to generate dynamic NBI bar charts or to generate bar charts from query results.
  - Access to standard queries—graphs and maps are preformatted and are readily available to browse or download.
  - Partial support to map bridge records from NBI queries and display significant bridge environment features such as roads, rivers, and rail lines.
  - Dynamic thematic map generation that displays bridge information such as the number of deficient bridges by county.
  - Ability to generate structure inventory and appraisal reports.

  These capabilities are now on the desktop of every bridge engineer within FHWA to ensure the safety, reliability, and security of the Nation's highway bridges.
- Cost-Effective Rehabilitation Strategies Using FWD Calibration Centers
  Billions of dollars are spent annually on pavement rehabilitation and resurfacing. To make the best possible decisions about where and when to conduct pavement rehabilitation work, State DOTs need extensive data on the pavement's structural condition. These data are obtained by using accurately calibrated equipment. FHWA calibration centers provide a critical resource to the States, which rely on consistent and accurate data to properly assess the structural condition of our Nation's highways and allocate limited resources effectively.
- High-Performance Concrete (HPC) Contributes to Rapid Bridge Reopening
  The successful rapid replacement of the U.S. I-65 bridge in Birmingham, AL, demonstrated what was achieved by using innovative practices and materials developed by FHWA R&T. After closure from an accident, the bridge was replaced and traffic capacity restored in a record 67 days.
- COST (Concrete Optimization Software Tool)
  HPC offers tremendous potential for improving the highway infrastructure. However, that potential relies on the correct mix components in the proper proportions for each project. COST is an online design and analysis system that enables concrete producers, engineers, and researchers to determine optimal concrete mixture proportions, making the highly complex mix design process more efficient and more manageable. Available online at http://ciks.cbt.nist.gov/cost/, COST is the culmination of a highly successful joint research effort by members of the Portland Cement Concrete Pavement (PCCP) team and researchers from NIST.
- Curved Structure Test
  A series of 16 experimental tests were performed to fully quantify the strength of curved I-girder

components (8 bending specimens, 4 shear specimens, and 4 moment-shear interaction specimens). An erection study was also conducted to investigate construction issues associated with horizontally curved steel I-girder bridges. The full-scale tests were used to validate a state-of-the-art computer simulation model that enabled researchers to generate thousands of "virtual" data points. Combined, these new data provided the basis for a complete rewrite of the AASHTO specifications for steel bridge design. The study began several years ago for the purpose of establishing LRFD codes for curved steel girders. The final testing phase will investigate elastic system behavior as well as ultimate bridge strength.

Curved I-girder components.

Operations

- ITS Intersection
  U.S. Transportation Secretary Norman Y. Mineta announced the opening of RD&T's newest test facility at TFHRC. The test intersection is the first of its kind in the United States and was designed to highlight intersection collision-avoidance systems that currently are being developed by the Infrastructure Consortium, a pooled fund with the States of California, Minnesota, and Virginia. This activity is sponsored in large part by the Intelligent Vehicle Initiative (IVI), a component of the ITS program. In addition to the traffic signals, controllers, special signing, and other equipment needed to support the operation of the intersection, a unique roadside-to-vehicle communication system will allow drivers of specially equipped vehicles to receive a warning when an intersection crash is imminent. In addition to supporting the intersection collision-avoidance demonstration, the new "intelligent intersection" will continue to serve as an outdoor lab for future FHWA intersection and traffic control research activities.

Intersection

- QuickZone
  The recently released QuickZone software is a work zone delay estimation tool that will provide a more complete and realistic view of total construction costs. QuickZone is a key component of FHWA's Strategic Work Zone Analysis Tools (SWAT) program. The QuickZone partnership program enables users to take advantage of open source code to customize the QuickZone software, thus providing State and local agencies with a tool that best meets their needs. With QuickZone, State highway agencies can evaluate a broad range of alternative work zone design and mitigation strategies in a relatively short time frame, resulting in better decisionmaking for highway construction projects. A recent QuickZone benefits study verified this important aspect of the program—traffic engineers were able to better predict the traffic effects of various work zone design strategies and more accurately stage their projects, thus saving money and time (see the RD&T Research Benefits Case Studies later in this report).
- Traffic Software Integrated System (TSIS)
  A new version of the TSIS was released. Containing numerous new features and enhancements requested by users, TSIS allows traffic engineers and planners to simulate traffic conditions and evaluation alternative advanced traffic management and control strategies to improve operations in an integrated network of arterials and freeways.

Intersection 2.

- Adaptive Control Software (ACS)
  ACS adjusts traffic signal timing to accommodate changing traffic patterns, helping to reduce stops and delays. Field testing and evaluation of two new ACS algorithms was completed in Seattle, WA, and Tuscon, AZ. The new ACS systems showed a 3–10 percent reduction in delay over traditional, fully optimized signal timing plans.
- Traffic Detector Handbook

  The Traffic Detector Handbook is a widely used reference to help practicing engineers and technicians plan, design, install, and maintain vehicle sensors that support traffic management on arterials and freeways. The handbook recently was updated to reflect new sensor and detection technologies that support advanced traffic management and ITS strategies.
- Nationwide Differential Global Positioning System
  NDGPS can pinpoint a person or vehicle's position to within 3 meters. NDGPS directs emergency responders to the exact location of a crash, makes it easier for highway agencies to monitor and respond to hazardous pavement conditions, provides drivers with in-vehicle route guidance, and contains a host of other transportation applications. NDGPS sites will form part of a nationwide operational GPS meteorological observing system that will enable the National Weather Service to provide more accurate weather forecasting.
- High-Accuracy Nationwide Differential Global Positioning System (HA-NDGPS)
  As part of its ongoing research efforts, RD&T modified an existing NDGPS facility to broadcast corrections that achieve 10-centimeter horizontal accuracy. Initial testing of the HANDGPS indicates that the new broadcast is accurate to within 10 centimeters and better in many areas. Further research is underway to modify an additional NDGPS facility to achieve faster and even more accurate navigation solutions.

2003 Release of the Interactive Highway Safety Design Model

The 2003 release of IHSDM culminates a multiyear R&D effort. Highway project decisionmakers now can use IHSDM to check designs for conformance with design policy, estimate their expected safety performance, and diagnose potential safety and operational issues throughout the highway design process. The 2003 release of IHSDM for two-lane rural highways has five evaluation modules: 1) policy review; 2) crash prediction; 3) design consistency; 4) intersection review; and 5) traffic analysis. Each module provides different measures of the expected safety performance of an existing or proposed highway geometric design.

The policy review module automates the current process of checking a design against applicable, quantitative design guidelines. The crash prediction module provides quantitative safety performance measures, including expected crash frequency and severity.

IHSDM

The remaining modules diagnose factors contributing to safety performance. The design consistency module assesses operating speed consistency. The intersection review module evaluates design elements that influence the safety performance of at-grade intersections. The traffic analysis module evaluates traffic operations on the roadway under current or projected traffic loads.

Additional capabilities are planned for future releases. Research is underway to develop capabilities for IHSDM to perform similar evaluations of multilane rural highways. A sixth evaluation module for two-lane rural highways, driver/vehicle, also is being developed and will provide measures of vehicle dynamics, including lateral acceleration and rollover and skidding potential (from Public Roads, January/February 2003, Vol. 66, No. 4, by R.A. Krammes and C. Hayden).

- Rumble Strips

  Rumble strips are raised or grooved patterns constructed on the roadway's shoulder. Vehicle tires passing over them produce a rumbling sound and cause the vehicle to vibrate. The noise and vibration produced by the strips are effective alarms for drivers who have drifted from their travel lane onto the shoulder. Several studies indicate that the strips can reduce the overall rate of run-off-the-road crashes by 15–70 percent, which also would lead to a reduction in the number of injuries and fatalities.

  FHWA has developed a Web site to address the crucial role of shoulder rumble strips. The site includes FHWA's Technical Advisory on Roadway Shoulder Rumble Strips and a synthesis of rumble strip information. The technical advisory provides FHWA's guidance on where and when rumble strips should be used. The synthesis is a review of the current practices of State DOTs, a review of recent shoulder rumble strip studies, and a review of common practices. The Web site

can be found at http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/ (from Public Roads, January/February 2003, Vol. 66, No. 4, by A.J. Nedzesky and R. Powers).

- Highway Safety Information Systems (HSIS)
  HSIS is a multistate information system that contains accident data for more than 5 million crashes, information about traffic volumes, and roadway inventory data covering approximately 265,650 kilometers of State highway systems. FHWA staff, contractors, university researchers, and others use HSIS to study current highway safety issues, to direct research efforts, and to evaluate the effectiveness of accident countermeasures. Through HSIS, FHWA works closely with States and other partners to gather data and improve our ability to analyze roadway safety challenges. HSIS helps FHWA direct investments to specific projects and programs that will deliver the most value in terms of saving lives and minimizing injuries.
- Pedestrian and Bicycle Crash Analysis Tool (PBCAT)
  Researchers at FHWA, in cooperation with the National Highway Traffic Safety Administration (NHTSA), developed the PBCAT to assist State and local coordinators, planners, and engineers with analyzing crashes and developing effective countermeasures. By analyzing data from actual crashes, such as where and when they occurred, characteristics of the victims, and the sequence of events leading up to the crashes, the PBCAT software can produce tables and graphs illustrating the relationships among various crash types and other factors associated with the crashes (age, gender, light conditions, etc.). PBCAT also provides recommended countermeasures linked to specific pedestrian and bicycle crash types. The PBCAT software and manual (FHWA-RD-99-192) are available at www.bicyclinginfo.org/bc/pbcat.htm (from Public Roads, January/February 2003, Vol. 66, No. 4, by C. Tan Esse).
- Roundabouts Information Guide
  FHWA developed Roundabouts: An Informational Guide, to help communities improve safety and mobility by placing roundabouts in appropriate areas. Experiences in the United States show that roundabouts reduce crashes by 37 percent, and decrease crashes involving injuries by 51 percent.

Roundabout.

- Highway Design Handbook for Older Drivers and Pedestrians
  Based on the characteristics of older drivers and pedestrians, this resource provides practitioners with practical information for incorporating specific roadway features into highway design, operations, and traffic engineering. The handbook showcases tools that address issues that enhance older driver and pedestrian safety and mobility.

Performance Management

Relevance, Quality, and Performance

The Office of RD&T uses criteria established by OMB— Relevance, Quality, and Performance—as the bases for assessing the need, relevance, appropriateness, quality, and performance of our research activities. Our approach to performance management builds on these three elements.

Relevance. RD&T program managers must be able to articulate *why* an investment is important, relevant, and appropriate. Our research activities, products, and services outlined in this plan are designed to support the Agency's goals and address customer needs.

Quality. RD&T program managers must justify *how* funds will be allocated to ensure quality research. Programs allocating funds through means other than a competitive, meritbased process must justify these exceptions and document how quality will be maintained. Quality is also assessed periodically through independent lab assessments.

Performance. RD&T program managers must be able to monitor and document **how well** this investment is performing. Program managers track R&T projects to determine whether the projects are on time and within budget, and assess whether to increase or redirect funding.

Planning and Priority Setting

FHWA's Office of RD&T coordinates the R&T program and supports FHWA and USDOT strategic goals for the Nation's transportation system. The FY 2002/2003 RD&T Performance Plan outlines FHWA research priorities and strategies and shows a clear link between research program goals and FHWA and USDOT strategic plans. Research highlighted in the RD&T performance plan focuses on providing solutions to complex technical problems by developing economical, environmentally sensitive designs; efficient, quality-controlled construction practices; and durable materials. The result will be a safer, more reliable highway transportation system.

Performance Management Framework

Different forms of evaluation are appropriate for different types of research programs and projects. The RD&T Performance Management Framework chart identifies performance measures used across the various organizational functions. It is used as an assessment mechanism for unit managers and helps to establish measures that are integrated across management functions. The framework reflects our Agency's Corporate Management Strategies (CMS), which are based on the Baldrige Criteria. The framework is a tool for managers to analyze and integrate information obtained from a variety of sources and mechanisms. It also helps ensure that various dimensions for analyzing program results, such as financial performance, customer feedback, and business results are examined comprehensively. The RD&T Leadership Council utilizes this framework as a tool to assess relevance, quality, and performance, and to identify gaps in measurement.

RD&T Performance Management Framework

CMS	Definition	Related RD&T Performance Measures	Methodology
Leadership	Leadership focuses on how senior leaders guide the organization. It describes how leaders set direction and high-performance expectations, project a strong customer focus, and communicate clear and visible values to employees.	• Leadership Effectiveness Inventory (LEI) results. • Action items completed. • Performance plan items fulfilled. • Self-assessment score.	• 360-degree feedback. • Action agenda. • Performance plans. • Quality self assessments.
Strategic Planning	Strategic planning examines how the organization sets strategic goals and develops key action plans.	• Action items completed. • Self-assessment score. • Progress made on goals established from lab assessment.	• Performance plans and action agenda. • Quality self assessments. • Lab assessments.
Customer/ Partner Focus	Customer and partner focus examines how the organization determines requirements and expectations of customers and markets.	• Percent of satisfaction with RD&T products and services. • Number of TFAPs in place. • Self-assessment score. • Lab assessment results. • RD&T customer survey results (to be determined).	• FHWA satisfaction survey. • TFAP. • Quality self assessments. • Lab assessments. • Customer surveys. • Web feedback links.
Information and Analysis	Information and analysis examines the management,	• Performance measurement framework.	• Performance management framework.

CMS	Definition	Related RD&T Performance Measures	Methodology
	effective use, and analysis of data and information to support key organization processes, to include the organization's objectives.	• Level and content of response on feedback mechanisms used. • Self-assessment score. • Lab assessment results.	• Quality self assessments. • Lab assessments.
Human Resource Development	Human resource development and management examines how the organization enables its workforce to develop to its full potential and how the workforce is aligned with the organization's objectives.	• Self-assessment score. • Percent employee satisfaction survey rating. • Percent payroll spent on training and development. • Number of Individual Development Plans in place in the Learning and Development System (LADS). • Number of priority 1 training needs met. • Number of vacancies filled. • Number of days positions are vacant. • Number of student interns. • Awards and recognition.	• Quality self assessments. • Employee satisfaction survey. • LADS.
Process Management	Process management examines aspects of	• Number of process	• Quality self assessments.

CMS	Definition	Related RD&T Performance Measures	Methodology
	how key production, delivery, and support processes are designed, managed, and improved.	improvements documented. • Lab assessment. • Number of contracts on time and on budget.	• Lab assessments. • Project tracking system. • Workload analyses.
Business Results	Business results show the organization's performance and improvement in its key business areas: customer satisfaction, financial and marketplace performance, human resources, supplier and partner performance, and operational performance. The category also examines how the organization performs relative to competitors.	• Percent of project completion. • Number of success stories. • Research benefit.	• Track project and services delivery/deployment of T&I. • RD&T success stories. • Pilot and case studies.

Performance Management Workgroup

The primary purpose of the Performance Management Workgroup is to help the RD&T leadership develop, coordinate, and implement organizational performance-improvement efforts. The workgroup also helps RD&T leadership improve the management of research programs and assists in the adoption of effective practices. Performance-management efforts currently underway include:

- Developing performance goals, measures, strategies, and initiatives to improve organizational performance management in RD&T offices and labs.
- Monitoring results of measures and analyzing performance management information.
- Coordinating the annual self-assessment process and supporting the RD&T Leadership Council in implementing solutions to issues raised during the process.
- Contributing to special projects related to RD&T performance management.
- Providing support for Agency-wide performance-improvement initiatives.

RD&T Research Benefits Case Studies

Measuring the contribution of highway research to the achievement of Agency and departmental goals poses a unique challenge because of the long-term nature of research and the level of risk involved. Research projects are multiyear undertakings, and the products developed from them undergo several years of evaluation and development before being accepted and implemented on a broader scale.

For such reasons, the USDOT acknowledges in its annual research, development, and technology plan that until the products of the research are fully developed and utilized, "current (research) efforts can have only modest impact on the attainment of specific performance goals." Over time, however, relevant and high-quality research programs can lead to innovations that exponentially benefit the public and lead to growth in the private sector.

Retrospective reviews of whether investments were well directed, efficient, and productive are essential for validating program design and instilling confidence that future investments will be appropriate. Retrospective RD&T benefit studies are conducted periodically to document the benefits of research products. RD&T periodically conducts benefits case studies to collect data on the benefits of research and, when possible, to document and gain further insight into linkages with Agency goals and outcomes.

The first series of studies has yielded potential performance measures for evaluating highway R&D databases, software tools, national design and data standards, and new materials technology. The methodologies used to determine the benefits derived from the research were documented and recommendations were made for measuring benefits both quantitatively and qualitatively. These metrics may be adapted and used as part of a contextual framework for RD&T program managers to assess the benefits of their research.

RD&T has conducted these evaluations with the understanding that there is no single approach to the issue of research performance measurement and benefits assessment and that a combination of evaluation methods within a unified framework will most likely yield the best results. This holistic perspective is supported by the findings of the NCHRP Synthesis 300 and is acknowledged by the OMB's recommended criteria for investment in research. The RD&T benefit assessments are largely retrospective analyses. However, similar approaches may be used to predict future benefits of research projects.

Case Study Highlights

Infrastructure R&D

HRDI completed a study that examined RD&T research benefits in the areas of national design and data standards, new technologies, and new materials development. This project identified performance measures and provided a framework to assess the benefits of research conducted by HRDI. The performance measures were developed based on data collected on selected projects completed by HRDI in the past 20 years. The guiding principle in the development of the performance measures and assessment framework was to ensure that the measures are relevant, that they capture all types of research activities, that they are objective enough to highlight the benefits and weaknesses of research programs and projects, and above all, are simple enough to be easily understood and applied by HRDI program managers.

Highway Safety Information System

HSIS is a multistate information system that improves highway safety and design. The HSIS performance assessment goal was to provide value indicators for the system. These indicators will be used to develop a broader framework to assess the benefits of research databases and information tools. Value indicators developed for the study included measurements of HSIS value to internal and external safety research

communities, and to State and local engineers and planners. Examples of HSIS indicators included bibliometric usage data, expert peer review data, and user survey results.

QuickZone

QuickZone's evaluation results revealed several useful product benefit measures for State DOT planners. The combination of customer survey data and user cost and benefit modeling proved particularly useful and resulted in immediate improvements to the product's input modules and analysis options. Software development is a research process that is difficult to measure with traditional metrics. The metric results from the study have a broader application potential in determining research benefits for similar RD&T products, particularly any software or model development.

Customer Feedback

To determine whether our research products are meeting the needs of our customers, RD&T seeks and obtains customer feedback through such mechanisms as formal surveys, Web links, and focus group meetings. A Customer Survey Workgroup is helping the Leadership Council identify existing mechanisms for customer feedback and to assess the need for surveys geared to specific segments of our customer base. A chart showing extensive stakeholder involvement throughout the R&T process was posted on Staffnet. The group is currently working with HAAM to test a Web-based survey it has developed that focuses on customer satisfaction with RD&T products.

RD&T Lab Assessment Process

RD&T lab assessments are independent expert reviews of the quality and performance of research conducted at TFHRC.

The assessment process is designed to:

- Enhance lab performance and quality by providing feedback to lab managers.
- Provide an opportunity to exchange views among technical experts.
- Create a feedback method that will increase the opportunities for customer and stakeholder input to research activities.
- Provide a credible, professional, and objective assessment that further improves stakeholder confidence in the value of the work performed and outcomes produced.

Stakeholder Advisory Activities and Feedback

The Research and Technology Coordinating Committee (RTCC)

The RTCC examines national highway R&T needs and roles and provides policy-level recommendations on the overall direction of the program. The RTCC committee consists of 18 members, including top-level administrators, researchers, and practitioners from the States, academia, and private sector. RTCC activities in FY 2003 included several high-level meetings with RD&T leadership and other highway research stakeholders on highway R&T topics (most recently, a symposium was held April 3–4, 2003, in Washington, DC). The symposium elicited stakeholders' views on how well highway transportation R&T programs conducted by the Federal Government are addressing the full range of national R&T priorities.

Tools for Measuring Performance at the State DOT Level

RD&T staff participated in a workshop on performance measures for State DOT research managers hosted by the Florida DOT in December 2002. One activity that grew out of that workshop, and

subsequent discussions with the AASHTO RAC, was an NCHRP project to develop a performance measurement toolbox for State DOT researchers. In addition to the toolbox, a database will be developed that will contribute to a nationallevel report showcasing the benefits of State research.

APPENDICES

Appendix A: RD&T Research Project Status

Appendix A: R&D Research Project Status, 5 photos included: law enforcement officer, date modeling, rumble strips, lab, snow plow.

The following charts detail TFHRC research and identify the goals that this research supports. The charts also indicate which projects were completed in FY 2003 and which ones are still ongoing for 2004 and beyond. The comment column provides reasons behind changes or deviations from the unit plan and schedule. In addition, we've included new projects that were not identified at the time the *FY 2002/2003 Performance Plan* was published.

Office of Infrastructure R&D

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Pavements/Asphalt									
Evaluation of the Laboratory	Jack Youtcheff HRDI-11	Mobility				X	Yes	Complete	New tool for assessment of storage stability

Asphalt Stability Test Report	202–493–3090								of modified binders. Funded by NCHRP in partnership with TRB.
Evaluation of the Particle Additive Test Report	Jack Youtcheff HRDI-11 202–493–3090	Mobility				X	Yes	Complete	New tool for assessing modified binder's compatibility with the Superpave binder specification. Funded by NCHRP in partnership with TRB.
FHWA Dynamic Angle Validation Kit	Tom Harman HRDI-11 202–493–3072	Mobility				X	Yes	Complete	Improved calibration of Superpave gyratories to address compliance issues. Funded by NCHRP in partnership with TRB.
A State-of-the-Practice Report in the Design of Crumb Rubber Material	Kathy Petros HRDI-11 202–493–3154	Mobility			X		No	Dec 2003	Updated information on the design of crumb rubber asphalt. The contractor had numerous health setbacks, which are delaying completion of the project.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Pavements/Portland Cement Concrete (PCC)									
Guidelines to Detect, Analyze, Treat, and/or Prevent Materials-Related Distress	Steve Forster HRDI-04 202–493–3070	Mobility				X	Yes	Complete	Improved PCCP forensic analysis. Reports printed. T2 package received. Workshop being considered. The results should provide for more systematic forensic analysis of PCCP.
Guidelines to Select Curing Materials and Procedures	Steve Forster HRDI-04 202–493–3070	Mobility				X	Yes	Complete	Guidelines for improved PCCP curing. Draft final reports under review.
Guidelines to Develop Statistical Quality Assurance Specifications	Peter Kopac HRDI-12 202–493–3051	Mobility			X		Yes	Oct 2003	Enhanced quality and uniformity of State quality assurance specifications. Project is 99 percent complete; final report is being prepared.
Freeze-Thaw Durability of Concrete Report	Marcia Simon HRDI-12 202–493–3071	Mobility			X		No	Dec 2003	Enhanced understanding of the freezethaw durability of concrete having “marginal” air contents. Laboratory testing delayed by equipment problems. Final report writing has begun.
Guidelines on the Use of Recycled PCCP as Aggregate in New PCCP	Steve Forster HRDI-04 202–493–3070	Mobility			X		No	Dec 2003	Research designs that consider recycled aggregate. Principal investigator is no longer with the contractor, which has delayed delivery of the final report.

Petrography Manual	Steve Forster HRDI-04 202–493–3070	Mobility			X		No	Dec 2003	State-of-the-art petrographic manual for PCC. Adding new techniques, including scanning electron microscope analysis. Draft report has been reviewed.
Vibrating Slope Apparatus to Measure PCC Workability, Equipment, and Test Method	Marcia Simon HRDI-12 202–493–3071	Mobility			X		Yes	Dec 2003	More meaningful assessment of concrete paving mixtures workability. Work being coordinated with the University of Texas.
HIPERPAV Software for Jointed Plain Concrete Pavement and CRCP Performance Behavior	Fred Faridazar HRDI-12 202–493–3076	Mobility			X		Yes	Jan 2004	Improved performance of PCCP. Contract was revised to add software refinements and an expand product delivery effort (workshops and technical support). Work is 98 percent complete.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Pavements/LTPP									
DATAPAVE 3.0, CD-ROM Software Package	Aramis Lopez HRDI-13 202–493–3145	Mobility				X	Yes	Complete	National software distribution to facilitate LTPP database usage. National distribution was made during the TRB annual meeting, and the software was used during an FHWA professor training workshop.
Dynamic Test System Protocol	Aramis Lopez HRDI-13	Mobility				X	Yes	Complete	Develop a new procedure to evaluate close-loop equipment.

	202–493–3145								Report completed and awaiting publication. 508 conversion is underway.
Estimating Cumulative Traffic Loads Report	Larry Wiser HRDI-13 202–493–3079	Mobility				X	Yes	Complete	Study of State DOTs using the new axle load spectra procedures. Report completed and is under technical and editorial review. It will be published in April 2004.
Improved Specifications for Weigh-In-Motion (WIM)	Larry Wiser HRDI-13 202–493–3079	Mobility				X	Yes	Complete	Improved WIM technology. The WIM specifications and guideline are available on the LTPP Web page.
Joint and Crack Load Transfer in LTPP Test Sections Report	Aramis Lopez HRDI-13 202–493–3145	Mobility				X	Yes	Complete	Improve the understanding of PCCP joint and crack load transfer. Report completed and is in the final stages of publication.
LTPP Database, Data Releases	Aramis Lopez HRDI-13 202–493–3145	Mobility				X	Yes	Complete	Make LTPP database available to the public. Two data releases completed during FY 2003 (January and July). The July 2003 data are available at the LTPP customer support office (LTPPInfo@fhwa.dot.gov)
Verification of LTPP Virtual Weather Stations Report	Aramis Lopez HRDI-13 202–493–3145	Mobility				X	Yes	Complete	To determine accuracy and factors affecting virtual weather stations. Report completed and awaiting publication and 508 conversion.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Pavements/Models									
Mechanistic Pavement Models	Bill Kenis HRDI-10 202–493–3149	Mobility				X	Yes	Complete	Tools for mechanistic design of pavements. Alpha systems for JSLAB and Vesyss pavement models available for use in designing pavements.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Pavements/Surface Anaylsis									
Measuring and Evaluating PCCP Warp and Curl	Dennis Sixbey HRDI-10 202–493–3078	Mobility				X	Yes	Complete	Methods for evaluating and mitigating PCC warping. Proof of concept study; conference paper (Best Paper Award); software development.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Structures/Steel									
Curved Girder Bridge Strength Prediction Equation	Bill Wright HRDI-06 202–493–3053	Mobility/Safety				X	Yes	Complete	Provide design guidance to AASHTO. Critical input to design protocol for curved steel structures.
Designers Guide for High-Performance Steel Bridges (HPS)	Bill Wright HRDI-06 202–493–3053	Mobility/Safety				X	Yes	Complete	Provide consistent accurate design guidance. Developed in cooperation with the FHWA Resouce Center.
Corrugated Web Plates for Steel Girders	Bill Wright HRDI-06 202–493–3053	Mobility			X		Yes	Dec 2003	Maximize bridge efficiency of design and capacity and maximize the efficiency of design for steel structures.
Improved Fracture Toughness Specifications for HPS	Bill Wright HRDI-06 202–493–3053	Mobility/Safety			X		Yes	Dec 2003	Maximize the design and performance benefits of advanced steels. Performance properties of HPS provide significant advantages in resistance to critical fracture not currently accounted for in design guidance.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Structures/Concrete									
HPC Database	Joey Hartmann HRDI-06 202–493–3059	Mobility			X		Yes	Dec 2003	Analyze the effectiveness of new generation concrete structural materials. Document the performance improvements obtained through the use of HPC.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Structures/Timber									
Design Guidance for Composite Timber Bridges	Sheila Duwadi HRDI-07 202–493–3106	Mobility/Safety		X			No	Indefinite	Provide guidance and assistance in fiberreinforced polymer (FRP) and glulam composite bridge design and construction. Funds are not available to complete this study.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Structures/Advanced Materials									
Specifications for Highway Bridge Applications Using FRP Composites	Eric Munley HRDI-06 202–493–3046	Mobility				X	Yes	Complete	Provide design guidance for State highway bridge engineers.

FRP Prestressing for Highway Bridges	Eric Munley HRDI-06 202–493–3046	Mobility			X		Yes	Dec 2003	Provide engineering option that improves strength and eliminates corrosion.
Materials Specifications: Accelerated Test-Based Specification	Eric Munley HRDI-06 202–493–3046	Mobility			X		Yes	Dec 2003	Provide information regarding expected performance of FRP materials.
Performance Specification and Acceptance Tests for FRP Bridge Decks and Superstructures	Eric Munley HRDI-06 202–493–3046	Mobility/ Safety			X		Yes	Dec 2003	Provide specification for the proper use of advanced materials.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Hydraulics									
Culvert Installation Provisions for AASHTO Bridge Specifications	John O'Fallon HRDI-07 202–493–3051	Mobility				X	Yes	Complete	Verified durability of aluminized coatings for metal pipe. Proposed provisions provided to the Office of Bridge Technology. Presentation made at AASHTO Culvert Committee Meeting.
Effects of Debris on Bridge Pier Scour	J. Sterling Jones HRDI-07 202–493–3043	Mobility/Safety				X	Yes	Complete	This study was selected as a NCHRP project 24-26 for FY 2004.
Improved Culvert Entrance Loss Prediction	J. Sterling Jones HRDI-07 202–493–3043	Mobility		X			No	June 2004	Test hydraulic performance of prefabricated vs. field cast culvert inlets is currently underway, but is behind schedule due to difficulties getting models fabricated.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Aerodynamics									
Mean Wind Force Coefficients for Hexagonal, Uniform, and Tapered Cylinders	Hal Bosch HRDI-07 202–493–3031	Mobility/Safety		X			No	Dec 2004	Provide more realistic coefficient for calculating wind load. This study is slightly delayed due to rehabilitation of the wind tunnel and the slow fabrication of tapered models. The models have now been delivered, but the study has been delayed further due to limited funds.
Stochastic Methods for Simulating 3-D Wind Flow Around Bridges	Hal Bosch HRDI-07 202–493–3031	Mobility/Safety		X			No	Dec 2005	Provide new tool for simulation and analysis of wind effects on bridges. This study is on hold due to budget cuts and limited access to the principal investigator. Funding is now available and the project has restarted. Documentation from previous work has been delivered.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Seismic									
Improved Seismic Design Provisions for AASHTO Bridge Specifications	Phil Yen HRDI-07 202–493–3056	Mobility			X		Yes	Jun 2004	Provide recommended seismic design specifications for highway bridges. Recommended seismic design specifications completed and proposed to AASHTO. More work required to adopt the specifications.
A Risk-Based Methodology For Assessing the Seismic Performance of Lifeline Systems Report	Phil Yen HRDI-07 202–493–3056	Mobility/Safety			X		Yes	Dec 2004	Tool to assist State bridge engineers in assessing loss estimation of earthquake damage. A computer program was completed and a report published. This tool has been calibrated and validated by a demonstration project (Northridge earthquake case study).
Seismic Retrofitting Manuals: Part III: Special Bridges	Phil Yen HRDI-07 202–493–3056	Mobility/Safety			X		Yes	Dec 2004	Provide nationally applicable seismic design and retrofitting guidelines for special bridges.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Geotechnology									
Non-Nuclear Compaction Control Equipment	Mike Adams HRDI-06 202–493–3025	Mobility				X	Yes	Complete	Provide a more user-friendly compaction test method. A means of accurately measuring construction compaction of soil without the need for a nuclear device.
Micropile Technology for Bridges	Al DiMillio HRDI-06 202–493–3035	Mobility			X		Yes	Dec 2003	Provide design and retrofit guidance for the use of micropiles. Particularly critical technology for retrofit of existing structures and structures with limited access for equipment.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Corrosion									
Knowledge-Based Tools for Bridge Coatings Maintenance Decisionmaking	Bob Kogler HRDI-06 202–493–3080	Mobility				X	Yes	Complete	Provide coating assessment tools to resident bridge engineers. Supplies a tool for conveniently assessing the condition of a coating on steel and provides options for repair.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Nondestructive Evaluation									
Automated Ultrasonic Inspection Methods	Glenn Washer HRDI-10 202–493–3082	Mobility			X		Yes	Dec 2003	Reduce the cost of steel bridge fabrication by using innovative technologies. The initial study is completed; the final report is being prepared.
Thermal Imaging System for Crack Detection	Glenn Washer HRDI-10 202–493–3082	Mobility			X		No	Sep 2004	Method to detect cracks and prevent failure of steel structures.

									Test setup complete, vendor has not supplied necessary equipment.
Ultrasonic Methods for Health Monitoring of Prestressing Tendons	Glenn Washer HRDI-10 202–493–3082			X			Yes	Sep 2004	Technology to prevent failures due to corrosion or tendon fracture. Prototype sensors built and tested; health monitoring applications currently being tested.
HERMES II Ground-Penetrating Radar System	Glenn Washer HRDI-10 202–493–3082			X			Yes	Oct 2005	Tools to rapidly survey concrete decks for deficiencies. Prototype system undergoing expanded testing under a new work plan in cooperation with State partners.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Applied Engineering/Bridge Management									
WebNBI: Internet-Based Query and Analysis System for the NBI Database	John Hooks HRDI-10 202–493–3023	Mobility				X	Yes	Complete	Provide basis for effective bridge preventive maintenance and preservation.

									WebNBI query system active and in use by FHWA HQ and field bridge engineers and planning staff.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Projects Not Reflected in 2002–2003 Plan									
Abutment Scour Field Data	J. Sterling Jones HRDI-07 202–493–3043	Mobility/Safety				X	Yes	Complete	Provide database with field data from South Carolina for comparison with predictions based on FHWA guidelines and new procedures being developed. Data report will be published as a U.S. Geological Survey Open File Report. It will be provided to researchers for NCHRP Project 24-20, “Prediction of Abutment Scour.”
Air Pollution Models for Complex Site Geometries	Howard Jongedyk HRDI-10 202–493–3077	Environment				X	Yes	Complete	Techniques to evaluate impacts of toxic spills. Model for dispersion of exhaust gases and toxic gases from chemical spills or terrorist attacks; applicable to complex urban sites and tunnels. Report printed.
Cost Analysis for Innovative Bridge Coatings Methods	Bob Kogler HRDI-06 202–493–3080	Mobility				X	Yes	Complete	Comparative cost information for bridge coating rehabilitation projects.

COST Web Site and Report	Marcia Simon HRDI-12 202–493–3071	Mobility				X	Yes	Complete	Web-based software to efficiently optimize concrete mix proportioning and achieve multiple performance criteria. Final report was submitted for printing. Web site: http://ciks.cbt.nist.gov/cost/.
Diffusion of Airborne Highway Pollutants	Howard Jongedyk HRDI-10 202–493–3077	Environment				X	Yes	Complete	Methodology to mitigate impacts of airborne pollutants.
Full-Scale Accelerated Performance Testing for Superpave and Structural Validation: Phase I—Construction	Terry Mitchell HRDI-11 202–493–3147	Mobility				X	Yes	Complete	National Superpave binder specification refinement to capture fully the benefit of modified binders. Pooled fund study TPF- 5(019) in partnership with the TRB Superpave Binder ETG.
Fundamental Properties of Asphalt and Modified Asphalts	Ernie Bastian HRDI-11 202–493–3075	Mobility				X	Yes	Complete	Expanded fundamental knowledge of asphalt and modified asphalts. Congressionally directed research activity.
Management of Highway Runoff in Karst Areas	Howard Jongedyk HRDI-10 202–493–3077	Environment				X	Yes	Complete	Techniques to prevent damage to sensitive geologies.
Performance Measures on the Benefits of	Shiela Duwadi HRDI-07	Mobility				X	Yes	Complete	A new framework for measuring the benefits of research.

Infrastructure RD&T	202–493–3106								
Preliminary Laboratory Investigation of the Performance of Modified Asphalt Binders in Mixtures	Kevin Stuart HRDI-11 202–493–3073	Mobility				X	Yes	Complete	National refinement of Superpave binder specifications to fully capture the benefit of modified binders. Validation of proposed changes to the Superpave binder specifications. Funded by NCHRP and the TRB Superpave Mix/Aggregate and Binder Expert Task Group (ETG).
Risk-Based Countermeasure Selection for Scour Critical Bridges	J. Sterling Jones HRDI-07 202–493–3043	Mobility				X	Yes	Complete	The HYRISK model has been posted on the FHWA bridge technology Web site at https://www.fhwa.dot.gov/engineering/hydraulics/. HYRISK is keyed to the National Highway Institute (NHI) database and has been revised to prioritize bridges from information based on the 2001 coding guide. HYRISK has a component for a risk-based selection of countermeasures for bridges with limited service life that will be a starting point for NCHRP 24-25.
Asset Management Suite of Pavement Models	Bill Kenis HRDI-10 202–493–3149				X		Yes	Nov 2003	Life-cycle costing analysis for pavements. Suite of models being developed.
Studies to Better Understand the Performance of Bridges Subjected to Near-Source Ground Motions (NSGM)	Hamid Ghasemi HRDI-07 202–493–3042	Mobility/Safety			X		Yes	Nov 2003	Studied the characteristics of NSGM. Analyzed the performance of Bolu Viaduct in Turkey, subjected to NSGM by generating synthetic records. A technical report will be generated.
Warp and Curl	Dennis Sixbey HRDI-	Mobility			X		Yes	Nov 2003	Improved analysis and design of PCC pavements.

Analysis Software	10 202–493–3078								Software analysis package being developed.
High-Energy Radiography for Structures	Glenn Washer HRDI-10 202–493–3082	Mobility			X		Yes	Jan 2004	Develop technology for detecting subsurface defects in concrete and steel bridges. Ongoing field testing to evaluate capabilities of the method; guidelines for field application being developed.
Technical Expertise on Grout Issues	Glenn Washer HRDI-10 202–493–3082	Mobility			X		Yes	Jan 2004	Technical assistance for inspection of post-tensioned bridges. Ongoing consultation and project development.
An Educational Guide to the History of Covered Bridges in the United States	Shiela Duwadi HRDI-07 202–493–3106	Mobility			X		Yes	Feb 2004	A guide designed to provide standards with a basic understanding of covered bridges.
Covered Bridge Manual	Shiela Duwadi HRDI-07 202–493–3106	Safety			X		Yes	Feb 2004	A guide to rehabilitate, restore, preserve, and reconstruct historic covered bridges.
Mixture-Specific Test Method for Alkali-Silica Reactivity	Marcia Simon HRDI-12 202–493–3071	Mobility		X			No	Apr 2004	Improve performance of PCCP. Continued delay in testing due to equipment problems. Expected resolution by October 2003.
Evaluation of the Proposed Simple Performance Test	Kevin Stuart HRDI-11 202–493–3073	Mobility		X			Yes	Jun 2004	New tool to improve the quality and performance of asphalt pavements. Funded by Revenue Aligned Budget Authority; requested by AASHTO.

Infrared Thermography for Infrastructure Inspection	Glenn Washer HRDI-10 202–493–3082	Mobility			X		Yes	Jun 2004	Technology for detecting delamination in bridge members. System built; new software developed; field testing underway.
Guidelines for Achieving High Levels of Smoothness Without Sacrificing PCC Performance	Peter Kopac HRDI-12 202–493–3151	Mobility			X		Yes	Jul 2004	Guidance to assure high smoothness and performance levels. Field testing and data collection underway.
Corrosion Control Design Guidance for Bridges	Bob Kogler HRDI-06 202–493–3080	Mobility	X				Yes	Sep 2004	Provide bridge engineers with knowledge and guidance to design more durable structures.
Smoothness Specifications	Dennis Sixbey HRDI-10 202–493–3078				X		Yes	Sep 2004	Improved pavement measurements made at highway speeds. Phases I and II—Determination of accelerometer requirements for inertial profilers at speeds from 24–120 kilometers per hour complete. Possible Phase III being considered.
Synthesis—Bridge Surveillance and Security Technologies	Shiela Duwadi HRDI-07 202–493–3106	Security	X				Yes	Oct 2004	Provide guidance on selection and implementation of bridge and tunnel security and surveillance systems.
Compendium of Knowledge on Pavement Models	Bill Kenis HRDI-10 202–493–3149	Mobility			X		Yes	Dec 2004	Text being written on basic principles of pavement models and analysis.

Feasibility of Bridge Design for Near-Fault Ground Motions	Hamid Ghasemi HRDI-07 202–493–3042	Mobility/Safety	X				Yes	Dec 2004	Develop simplified design procedures for bridges built close to an active fault.
Evaluation of GSB-88 Emulsified Sealer	Kevin Stuart HRDI-11 202–493–3073	Mobility		X			Yes	Sep 2005	Product intended to increase pavement service life. Congressionally directed research activity.
Design and Material Specifications for FRP/Glulam Bridges	Shiela Duwadi HRDI-07 202–493–3106	Mobility/Safety			X		Yes	Oct 2005	New specifications for adoption by AASHTO.

Office Of Operations R&D

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Intelligent Vehicle Initiative (IVI) and Human Centered Systems									
Guidelines for In-Vehicle Display Icons	Tom Granda HRDS-07 202–493–3365	Safety/Mobility				X	Yes	Complete	Diverse industry working group guided development. Original equipment manufacturer suppliers expressed interest in the product.
Synthesis of Practices Addressing Consistency in Text-Based Messaging for Advanced Traveler	Tom Granda HRDS-07 202–493–3365	Safety/Mobility				X	Yes	Complete	Review of ATIS operator practices in selecting, filtering, and assembling dynamic message sign messages. Survey of the diverse text message delivery systems to understand the baseline system, the various types of

Information Systems (ATIS)									messages being presented, and the decisionmaking processes for those messages.
Specialty Vehicles Technologies Evaluation	Randy VanGorder HRD0-03 202–493–3266	Safety/Mobility			X		No	Nov 2003	Final review of evaluation report in progress. Minnesota DOT resubmitting final reports in HTML format for 508 compliance and Web posting.
Enhanced Digital Mapping	Toni Wilbur HRD0-01 202–493–3269	Safety			X		Yes	Apr 2004	A cooperative partnership with industry to develop specifications and improve driver assistance systems.
Intersection Collision and Roadway Crash Avoidance/Infrastructure Systems Concepts and Requirements	Bob Ferlis HRDO-02 202–493–3268	Safety	X				Yes	Jan 2005	Organized as a pooled fund project to develop functional requirements and demonstration systems for infrastructure-based intersection collision avoidance systems.
Transportation Management Center (TMC) National Pooled Fund Study Results	Tom Granda HRDS-07 202–493–3365	Safety/Mobility		X			Yes	Sep 2006	Developed several references for TMC operations. For more information, see the pooled fund Web site at http://tmcpfs.ops.fhwa.dot.gov/index.cfm.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Traffic Control and Operations									
ACS—Development	Deborah Curtis HRDO-03 202–493–3267	Mobility				X	Yes	Complete	Weather and evacuation papers prepared; product handoff to Office of Operations done. Preparing one-page marketing tool.

ACS—Field Test	Raj Ghaman HRDO-03 202–493–3270	Mobility				X	Yes	Complete	
Freeway Management Handbook	James Colyar HRDO-03 202–493–3282	Mobility/ Productivity				X	Yes	Complete	Updated and revised handbook. Will be available for free download in December 2003. For more information, visit www.nawgits.com/icdn/fmoh.html.
Traffic Control Systems Handbook	Raj Ghaman HRDO-03 202–493–3270	Mobility			X		Yes	Dec 2003	Update underway.
ACS "Lite" Version Software	Gene McHale HRDO-03 202–493–3275	Mobility		X			Yes	Jan 2004	Software development expected to be complete in December 2003. Hardware interface under development; expected late 2003. Lab testing expected June 2004. Field testing expected July 2005. Final report and evaluation expected October 2005.
Traffic Detector Handbook	Dave Gibson HRDO-04 202–493–3271	Safety/ Mobility/ Environment			X		Yes	Jul 2004	An update to the handbook describes design requirements, installation, and maintenance procedures for transportation sensors. Update complete; currently making report 508 compliant.
Winter Weather Maintenance Decision Support Systems	Randy VanGorder HRDO-03 202–493–3266	Safety/ Mobility/ Productivity/ Environment			X		Yes	Oct 2004	The demonstration has been extended through FY 2004 to take the evaluations and lessons learned from the first demonstration to enhance and better refine the system.

	Rudy Persaud HRDO-04 202–493–3391								
Support to Office of Operations on Devices—Manual on Uniform Traffic Control Devices (MUTCD) Signing Issues	Tom Granda HRDS-07 202–493–3365	Safety/Mobility		X			Yes	Nov 2004	Role of FHWA regarding in-vehicle information. Phase II to begin in FY 2004.
Ramp Metering 2000 Software	Deborah Curtis HRDO-03 202–493–3267	Mobility				X	Yes	Dec 2004	Working with Office of Operations to determine next steps for product. Contract issues were resolved. Software development completed May 2003. Currently performing simulation evaluation. Field test planned for summer 2004.
DynaMIT—Field Test in Los Angeles, CA	Henry Lieu HRDO-03 202–493–3273	Mobility	X				Yes	Feb 2006	This project integrates CLAIRE, DynaMIT and Advanced Incident Detection Algorithm in Los Angeles, CA for real-time traffic management on arterials. The project started in September 2003.
DynaSMART-X—Field Test in Houston, TX	Henry Lieu HRDO-03 202–493–3273	Mobility	X				Yes	Mar 2006	This project integrates CLAIRE, DynaSMART-X and RHODES in Houston, TX. FHWA will provide Texas DOT with the three software packages for field test. The project is scheduled to start by late 2003.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Traffic Simulation Modeling									
DynaSMART-P—Release and Technical Support	Henry Lieu HRDO-03 202–493–3273	Mobility				X	Yes	Jan 2004	DynaSMART-P will be released to the public in early 2004.
QuickZone Work Zone Delay Estimation Tool	Deborah Curtis HRDO-03 202–493–3267	Mobility/ Productivity			X			Jan 2004	Working on cost-estimate tool. QuickZone 2.0 to be released January 2004.
Strategic Work Zone Analysis Tools (SWAT)	Deborah Curtis HRDO-03 202–493–3267	Mobility/ Productivity		X			Yes	Dec 2004	Working on impact-analysis tools.
GPS Surface Observation System Installation for Integrated Precipitable Water Vapor (IPWV)	Jim Arnold HRDO-04 202–493–3265 Rudy Persaud HRDO-04 202–493–3391	Safety/ Mobility/ Productivity/ Environment/ Security		X			Yes	Dec 2005	Install GPS surface observation system packages at NDGPS sites to calculate the IPWV from the accurate measurements of the GPS signal delay caused by atmospheric water vapor.
NDGPS Base Stations	Jim Arnold HRDO-04 202–493–3265	Safety/ Mobility/ Productivity/ Environment/ Security		X			Yes	Dec 2005	
NDGPS Coverage Verification Test Jig	Jim Arnold HRDO-04 202–493–3265	Safety/ Mobility/ Productivity/ Environment/ Security	X				Yes	Dec 2005	
DynaMIT-P—Field Test in Hampton Roads, VA	Henry Lieu HRDO-03 202–493–3273	Mobility	X				Yes	Jan 2006	The project began in May 2003.

Next Generation Simulation Modeling	Gene McHale HRDO-03 202–493–3275	Mobility	X				Yes	Dec 2007	

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Projects Not Reflected in 2002—2003 Plan									
Cooperative Program for Operational Meteorological Education and Training for Road Weather Forecasting	Rudy Persaud HRDO-04 202–493–3391	Safety/ Mobility			X		Yes	Jan 2004	This project will create a mesoscale network of hourly weather observations using Roadway Weather Information Systems. Final report being compiled.
Unmanned Aerial Vehicle for Aerial Surveillance	Dave Gibson HRDO-04 202–493–3271	Safety/ Mobility			X		Yes	Mar 2004	Uses model airplane for traffic surveillance and potential transportation system inspections.
Surface Transportation Security and Reliability Information System Model Deployment	Toni Wilbur HRDO-01 202–493–3269	Safety/ Mobility/ Security	X				Yes	May 2007	
High-Accuracy Nationwide Differential Global Positioning System (HA-NDGPS)	Jim Arnold HRDO-04 202–493–3265	Safety/ Mobility/ Productivity/ Environment/ Security	X				Yes	Dec 2007	Research program to evaluate the potential for achieving very high accuracy navigation solutions using existing infrastructure.

Traffic Software Integrated System (TSIS)	Raj Ghaman HRDO-03 202–493–3270 Gene McHale HRDO-03 202–493–3275	Mobility				X	Yes	N/A	Software maintenance ongoing.

Office Of Safety R&D

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Run-Off-the-Road Prevention: Design									
IHSDM—2003 Public Release	Ray Krammes HRDS-05 202–493–3312	Safety					Yes	Complete	This suite of safety evaluation software modules incorporates available knowledge about roadway safety and geometric design into a more useful format for highway planners and designers.
Night Driving and Lighting Requirements for the Older Driver	Kenneth Opiela HRDS-05 202–493–3371	Safety				X	Yes	Complete	Final report completed and in print.
Updated Minimum Levels for Pavement Marking Retroreflectivity	Kenneth Opiela HRDS-05 202–493–3371	Safety			X		No	Rescheduled Jan 2004	Progress has been made in verifying and validating past efforts, but the need to revise the sign retroreflectivity values has delayed completion of this effort; 9-month extension is

									anticipated for this project.
Minimum Fluorescent Requirements for Traffic Signs	Carl Andersen HRDS-05 202–493–3366	Safety	X				No	Mar 2004	Delayed due to difficulty in finding specifically configured fluorescent material.
Guidelines for Assuring Systemwide Adequacy of Traffic Sign Visibility at Night	Kenneth Opiela HRDS-05 202–493–3371	Safety	X				Yes	Jun 2004	Tables of minimum requirements for traffic sign retroreflectivity have been completed, IDIQ with TTI initiated.
Enhanced Night Visibility Project Followup Study Results	Carl Andersen HRDS-05 202–493–3366	Safety		X			Yes	Dec 2004	Initial project extended through May 31, 2004.
IHSDM—Driver/Vehicle Module Beta Test	Ray Krammes HRDS-05 202–493–3312	Safety					No	Sep 2005	This module needs additional work, which we are deferring to FY 2003/2004. It will not be part of the 2003 release of IHSDM.
Requirements for Light-Emitting Diode (LED) Traffic Signals	Carl Andersen HRDS-05 202–493–3366	Safety					Yes	June 2006	Not started. Exploring cooperative agreement with NIST.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Bicyclist									
ities Safety User Guide	Ann Do HRTS-06 202–493–3319	Safety				X	Yes	Complete	Information available and distributed to public on how to identify the safety and mobility needs of pedestrians within roadway rights-of-way.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Speed Management									
USLIMITS: A Preliminary Expert System for Speed Zoning	A.J. Nedzesky HRDS-05 202–493–3369	Safety				X	Yes	Complete	Updated version available for testing.
Variable Speed Limit Technical Assessment Plan	A.J. Nedzesky HRDS-05 202–493–3369	Safety			X		No	Jul 2003	A report on judicial enforcement of variable speed limits was published in March 2002 as *Legal Research Digest Number 47*.
Prototype Variable Speed Limit Systems in Work Zones	A.J. Nedzesky HRDS-05 202–493–3369	Safety		X			No	Aug 2003	Field testing completed in Michigan.
Recommended Designs for Hump Signs and Markings	Thomas Granda HRDS-07 202–493–3365	Safety			X		No	Aug 2003	Project delayed due to changes in the MUTCD. It now has guidelines for hump signs.
Results of Field Tests on Impacts of Setting and Enforcing Rational Speed Limits	A.J. Nedzesky HRDS-05 202–493–3369	Safety		X			Yes	Dec 2005	Results from first wave of demonstration projects due 8/28/03.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Intersections									
Accident Warrant for Traffic Signals	A.J. Nedzesky HRDS-05 202–493–3369	Safety				X	Yes	Complete	Published in *NCHRP Report #491*, available June 2003.
Functional Requirements for Microsimulation-Based Surrogate Safety Measures at Intersections	Joe Bared HRDS-05 202–493–3314	Safety				X		Complete	Complete Published in FHWA-RD-03-050.
Traffic Operations and Safety Comparisons of Single Point Urban Interchange with Tight Diamond Interchange	Joe Bared HRDS-05 202–493–3314	Safety				X	Yes	Complete	
Roundabout Accessibility Study	Joe Bared HRDS-05 202–493–3314	Safety	X				Yes	Sep 2004	Analyze and evaluate crossing of blind pedestrians at roundabouts.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Target Completion Date	Comments
			25	50	75	100			
Human Centered Systems									
Revised Older Driver Design Handbook	Thomas Granda HRDS-07 202–493–3365	Safety				X	Yes	Complete	Handbook, guidelines, and recommendations are on the TFHRC Web site.

Appendix B: RD&T Services, 5 photos: computer monitor, research publication cover, Public Roads issue, library, meeting.

The following charts outline the services provided by RD&T over the past year in the area of technical and program support for FHWA R&T nationwide.

Office of Infrastructure R&D

Service	Technical Contact	Comments
Structures		
Testing new and innovative materials and projects.	Bob Kogler HRDI-06 202–493–3080	Testing and evaluation focuses on high value-added, innovative materials that promise significant benefits over the current materials commonly used for highway applications. Materials such as HPS, UHPC, FRP, and high-durability corrosion protection materials are investigated.
Forensic evaluations of catastrophic failures or risk analysis in the areas of bridges and bridge components.	Bill Wright HRDI-06 202–493–3053	Expertise obtained through lab and field research is applied to explain the cause of catastrophic structural failures and develop recommendations for remedial action.
Studies to resolve unique or very complex design situations in bridge foundations, abutments, and retaining walls.	Mike Adams HRDI-06 202–493–3025	Provide technical input to FHWA field staff and State DOT engineers about the use of innovative geotechnical applications, including Geosynthetic Reinforced Soil (GRS) abutments and walls, micropiles, and data from the Geotech Research Database.

Forensic evaluations of catastrophic failures or risk analysis in the areas of hydraulic erosion and bridge and culvert stability.	J. Sterling Jones HRDI-07 202–493–3043	Provided user support to engineers in North Carolina and Idaho in applications of the HYRISK model to small bridges with unknown foundations.
Studies to resolve unique or very complex design situations in hydraulic capacity, efficiency, and effectiveness.	J. Sterling Jones HRDI-07 202–493–3043	Flume studies were conducted for: 1) The Woodrow Wilson Bridge to determine scour impact from leaving the existing foundations after the new bridge is complete; 2) the Blennerhassett Bridge to investigate potential pier scour problems; and 3) bottomless culverts to determine outlet scour and to evaluate various countermeasures.
Forensic evaluations of catastrophic failures or risk analysis in the areas of aerodynamic-induced failures of bridges and bridge components.	Hal Bosch HRDI-07 202–493–3031	Continued to monitor the post-retrofit wind response and behavior of the Deer Isle- Sedgwick Suspension Bridge. Evaluated possible cable vibrations on the Chesapeake and Delaware Canal cable-stayed bridge.
Studies to resolve unique or very complex design situations in aerodynamic stability of bridge and bridge components.	Hal Bosch HRDI-07 202–493–3031	Participated in several meetings about the preliminary design of the Blennerhassett Bridge. Completed field measurements of a new stay-cable system's dynamic properties on the Charles River Bridge.
Technical assistance to State highway agencies on pushover analysis approach.	Hamid Ghasemi HRDI-07 202–493–3042	Provided training to South Carolina DOT engineers about the push-over analysis technique to determine the bridge capacity.
Technical assistance to Turkish Highway Agency (KGM).	Hamid Ghasemi HRDI-07 202–493–3042	Providing technical assistance to KGM on the selection of appropriate earthquake protective systems. Technical information on near-source ground motions also being discussed.
Application of bridge management information systems to better understand bridge performance and develop improved performance measures for bridges.	John Hooks HRDI-10 202–493–3023	Studies involve NBI data mining to develop bridge condition prediction models, isolate causes of bridge deficiencies, develop performance measures, and develop innovative approaches to bridge management.
Application, evaluation, and development of specialized instrumentation for nondestructive evaluation, measurement, and long-term monitoring of highway structures.	Glenn Washer HRDI-10 202–493–3082	Assist States with technology for the detection of broken wires in cable stayed bridges. Imaging of post-tensioning strands in concrete beams, and detecting voids in the grouted post-tensioned ducts.
Technical expertise and consultation in bridge coatings and corrosion materials and techniques to other government agencies, States, and industry groups.	Shuang-Ling Chong HRDI-10 202–493–3081	Providing advice to States on the reliability and reproducibility of three of the most popular commercial test kits for determining chloride concentration on steel surfaces prior to bridge coating application.

Service	Technical Contact	Comments
Pavements		
Lab testing of new, innovative, and recycled materials used in pavement construction.	Tom Harman HRDI-11 202–493–3072	Evaluated crumb-rubber material and recycled polyester fiber polymers in the lab and in full-scale testing.
Technical expertise, assistance, and lab testing support for field trials of new pavement materials and procedures.	Tom Harman HRDI-11 202–493–3072	Evaluated polymer-modified materials in the laboratory and in full-scale testing at the FHWA pavement testing facility and in partnership with the National Center for Asphalt Technology.
Technical assistance and information on the application, testing, specifications, cost, and performance of recycled pavement materials.	Tom Harman HRDI-11 202–493–3072	Asphalt team continues to provide technical assistance on a national basis to our State partners, industry, and FHWA Federal Lands.
Forensic evaluations of performance problems in concrete pavements; technical assistance in various materials and testing areas.	Marcia Simon HRDI-12 202–493–3071	Activities include conducting petrographic examinations of pavement and bridge concrete for several States, and providing technical assistance to States and FHWA Division Offices.
Technical assistance in the application, testing, evaluation, and problem solving for construction quality control, quality assurance, performance-related specifications, and warranties.	Peter Kopac HRDI-12 202–493–3151	Provided advice to States interested in adopting new specifications or in validating the effectiveness of current specifications.
Access to the world's largest and most comprehensive pavement performance database. Technical assistance and consultation in pavement data use.	Aramis Lopez HRDI-13 202–493–3145	During the first and second quarters of 2003, the LTPP customer office received 318 requests for LTPP data and/or information. There have been 103 data requests, 109 questions, and 106 requests for materials and other LTPP information.

Service	Technical Contact	Comments
Traffic Analysis and Modeling		
Traffic Research Laboratory (TReL) model simulation and problem solving studies.	Randy VanGorder HRDO-03 202–493–3266	The TReL provides a support environment to the Advanced Transportation Management Systems Team and ITS programs. The following is a list of current support efforts: Simulation of emergency evacuations; air pollution simulation; WESTA (Weigh Station) Model Evaluation (exclusive bus lane simulation); Model Evaluation (Paramics, VISSIM, AIMSUN); Dynamic Traffic Assignment; ACS Lite support; railroad grade crossing preemption; and demonstration and outreach activities.

Service	Technical Contact	Comments
Communication and Frequency Spectrum Support		
Dedicated short-range communications program support for standards and ITS applications.	Jim Arnold HRDO-04 202–493–3265	Providing technical analysis and general guidance for the development of a dedicated short-range communications standard at 5.9 gigahertz.
Ultrawide-band radar technology coordination.	Jim Arnold HRDO-04 202–493–3265	Provide technical support for other FHWA offices on spectrum planning and allocation through the National Telecommunications and Information Administration and support OST in its efforts to better understand the implications of ultrawide-band radar technology on existing users of the radio spectrum.
Frequency spectrum coordination for FHWA.	Jim Arnold HRDO-04 202–493–3265	Support various organizations in FHWA to find appropriate spectrum for specific applications and work with the field and the United States Coast Guard (USCG) to ensure the availability of spectrum for various applications.

Service	Technical Contact	Comments
Research Program Support		
IVI Infrastructure Consortium coordination and leadership.	Bob Ferlis HRDO-02 202–493–3268	Provide technical leadership in the development of intersection collision avoidance services.
United States-Japan ITS Joint Research Program.	Bob Ferlis HRDO-02	Identify promising opportunities for collaboration and assemble technical materials to share with Japan.

	202–493–3268	
High-Speed Rail IDEA (Innovations Deserving Exploratory Analysis) program support.	Dave Gibson HRDO-04 202–493–3271	Review technical proposals on high-speed rail. Receive approximately 20 proposals per year.
Small Business Innovation Research (SBIR) program support.	Dave Gibson HRDO-04 202–493–3271	Coordinate submission of project statements to SBIR program.
University Research Program coordination and support.	Dave Gibson HRDO-04 202–493–3271	Coordinate projects with Texas A&M and University of Central Florida. Provide feedback to Office of Operations.

Service	Technical Contact	Comments
Human Centered Systems		
Review potential safety effects of electronic billboards on driver attention and distraction.	Tom Granda HRDS-07 202–493–3365	Report delivered to FHWA Office of Real Estate Services. Customer was pleased and placed the report on their Web site.

Service	Technical Contact	Comments
Safety Analysis and Management		
Research methods support and provide HSIS data to requesting parties.	Carol Tan Esse HRDS-06 202–493–3315	Ongoing.
Photometric and radiometric measurements of light sources, including traffic signals, vehicle headlamps, and roadway lighting.	Ray Krammes HRDS-05 202–493–3312	Spectro-radiometric measurement of LED traffic signal lights for the Institute for Transportation Engineers (ITE): support for colorimetric requirements in ITE specification. Spectro-radiometric measurement of high-intensity discharge headlights on hold pending NHTSA approval of selection of items to be measured.
Photometric and colorimetric measurements (including coefficient of retroreflectivity and fluorescence) of signing and marking materials.	Ray Krammes HRDS-05 202–493–3312	Round-robin measurement of weathered sheeting for National Transportation Product Evaluation Program. Round-robin measurement of samples used by Highway Innovative Technology Evaluation Center

		(HITEC) for evaluation of handheld retroreflectometers. Series of bispectral measurements of fluorescent sheeting in support of proposed rulemaking, Office of Transportation Operations.
Implement the FHWA *Corporate Master Plan for Research and Deployment of Technology & Innovation*.	Pete Markle HRT-01 202–493–3181 or Joe Conway HRTS-03 202–493–3186	FHWA CMP, which includes 26 Agency Commitments, completed. CMP included formal recognition and organization of the FHWA R&T Leadership Team, with primary responsibility for implementing the CMP. CMP provided throughout FHWA and to external stakeholders, and briefed to several key stakeholders; it was well received both internally and externally. CMP posted on FHWA public Web site. List of FHWA Priority, Market-Ready T&Is, which incorporates the nine AASHTO TIG items, completed; this is one of the CMP Agency Commitments. Workshop on deploying/implementing the list held jointly by FHWA and AASHTO TIG.

Office Of Program Development And Evaluation

Service	Technical Contact	Comments
Legislative monitoring and analysis.	Tom Krylowski HRPD-01 202–493–3470 Norm Paulhus HRPD-01 202–493–3491	Developed actual legislative language dealing with research, technology, and education included in the Administration's proposal for SAFETEA. Proposals were developed in conjunction with an internal RD&T working group and the FHWA-wide Legislative Affairs Working Group. Monitored and tracked the evolving positions of stakeholder groups on reauthorization and research to identify and understand stakeholder positions, not to promote any organization, group, or locality. The information was critical in the development of agency input for the Administration's reauthorization proposal, as well as in tracking reactions of groups to other versions of the proposed legislation.
SBIR review and support.	Norm Paulhus HRPD-01 202–493–3491	HRPD enhanced communication with the Volpe Center and with the financial management staff on SBIR program issues.

TPF Program.	Lisa Williams HRPD-01 202–493–3376	HRPD provided administrative assistance to States and sponsoring organizations interested in establishing pooled fund projects by reviewing and processing requests; circulating proposals for technical review; and updating information on the FHWA's TPF Web site. FHWA-led projects (139)—valued at approximately $58.5 million; $27.4 million remaining available to the projects with an average of 9.8 partners and the average study valued at $460,000. State-led projects (151)—valued at approximately $71.5 million; $37.8 million remaining available to the projects with an average of 7 State partners per study with the average study valued at $475,000.
TRB.	Bill Zaccagnino HRPD-01 202–493–3183	Contract managed by HRPD to provide technical expertise access to TRB. HRPD support provided for the TRB annual meeting. Coordination of NCHRP support, balloting, and solicitation of problem statements.

Office Of Resource Management

Service	Technical Contact	Comments
Accountable property inventory.	Denise Seward HRRM-01 202–493–3471	RD&T recently conducted a complete physical inventory of accountable property. The accountable property inventory maintained by the group is valued at $14.5 million.
Employee training and professional development.	Freddie Forster HRRM-01 202–493–3298	Coordinated and provided computer training courses in Microsoft Access, Microsoft Excel, HTML programming, Microsoft FrontPage® 2000, and Microsoft PowerPoint®. Provided professional development opportunities for employees through college courses on various engineering research subjects, including "Evaluation and Mitigation of Seismic Hazards," "Mathematical Statistics," and "Modeling and Simulation for Intelligent Transportation Systems." Courses were funded for RD&T employees, and FHWA courses were offered to employees at no cost.
Contracts and procurements.	Sue Stanton HRRM-01	Coordinated mandatory Contracting Officer's Technical Representative (COTR) refresher training

	202–493–3480	for RD&T employees. Ensured that COTRs took the basic COTR training and the mandatory 4-hour annual refresher training. Coordinated mandatory ethics training for RD&T COTR employees.
Procurement management and administration of Activity 10 budget.	Georgia Curtis HRRM-01 202–493–3180	Monitored and controlled expenditures to ensure limits were maintained. Developed and submitted call for annual budget. Prepared monthly reports for management. Reconciled budget reports with the Agency accounting system. Reviewed all procurement requests and review compliance with procedures and policies.

Office Of Research And Technology Services

Service	Customer	Contact	Brief Summary of the Nature of Services Performed	Number/Frequency of Services per FY 2003 Estimates
Periodical publications: • Public Roads (bimonthly) • Transporter (monthly) • Focus (monthly)	FHWA and Transportation Community	Strategic Communications Team 202–493–3468	Work with editorial board to develop issue themes and articles to support FHWA R&T programs. Develop article(s) content and guide writers for appropriate story angles and audience. Provide entire suite of publication services, including all writing/editing phases, style guidelines and	Bimonthly Monthly Monthly

			design layout, other camera-ready preparation services, printing, Web site posting, distribution.	
Strategic marketing and communications plans.	FHWA	Strategic Communications Team 202–493–3468	Work with project managers to facilitate T2 deployment activities targeted to specific users. Includes action plan of outreach tools and activities such as events, publications, Web presence, public service announcements.	Periodic
RD&T research reports and marketing and informational publications.	FHWA and Transportation Community	Strategic Communications Team 202–493–3468	Provide entire suite of publication services, including all writing/editing phases, style guidelines and design layout, other camera-ready preparation services, printing, Web site posting, distribution.	65
Other publications, FHWA news, *Technology Talks* (TT) newsletter.	FHWA	Strategic Communications Team 202–493–3468 Marketing Team 202–493–3467	Develop input to internal newsletters. Compile TT newsletter and distribute electronically.	Quarterly 36
Full-service RD&T Web site content and HTML programming support.	FHWA	Strategic Communications Team 202–493–3468	Complete document preparation with HTML coding,	Thousands of HTML coded text pages (508 compliant)

			and PDF preparation for thousands of pages of RD&T reports, directories, newsletters, brochures, etc.	PDF documents
TFHRC visitors program.	FHWA and Transportation Community	Strategic Communications Team 202–493–3468	Schedule and coordinate tours with RD&T labs, speakers. Arrange for meeting room(s), audio/visual needs, refreshments (e.g., lunches, coffee breaks), informational kits, and technical meetings.	Approximately 1,200 individuals per year
FHWA exhibit, events, and program support services.	FHWA	Marketing Team 202–493–3467	Warehouse storage and shipping of FHWA program displays and conference handouts. Full-service support of FHWA program office exhibitions for all of FHWA and OST.	Exhibit shipping services for 115 events Full-service support for eight national FHWA crosscutting events
FHWA R&T Product Distribution Center.	FHWA and Transportation Community	Marketing Team 202–493–3467	Management of R&T Product Distribution Center, distributing hard copy publications and CD-ROMs to FHWA customers, nationally and abroad.	Approximately 8,000 mailings per year
FHWA meeting and conference support services.	FHWA	Marketing Team 202–493–3467	Full-service support for logistics	24

			planning and support of FHWA-sponsored meetings for program offices. Services include hotel meeting space rental, meeting invitations and announcements, invitational travel, speaker(s) support, etc.	
Audio/visual/computer marketing productions; photography, VHS tape and digital filming; computer presentation services; and CD reproductions.	FHWA	Marketing Team 202–493–3467 Strategic Communications Team 202–493–3468	Multimedia services for RD&T program offices for still photography, VHS or digital filming services, computer presentations preparation, and CD production or duplication (i.e., photographs, promotional VHS tapes, short movies, Microsoft PowerPoint presentations, CD productions for presentations).	Frequent; on-call service
T&I deployment—"Raise the Bar."	FHWA and Transportation Community	Marketing Team 202–493–3467	Meetings and other logistical arrangements. Assist with final publication of Corporate Master Plan for Research and Deployment of Technology & Innovation, and other support activities.	Full support

Appendix C: Market - Ready Technologies

Appendix C:Market-Ready Technologies, 4 photos included: lab, changeable speed limit sign, bridge contruction, computer.

The following T&Is have been identified as warranting special attention. Technologies on this list are ones that:

- Support Agency priorities, including strategic goals (particularly the "vital few," which are marked by an asterisk *).
- Indicate strong user need and likelihood of implementation.
- Are developed to the point of being truly market ready, with a tool(s) available for the field to market.
- Have expertise available to support deployment and implementation.

This list is not intended to include all T&Is available. Numerous T&Is are being developed, but are not yet ready to be marketed in the field. In addition, many T&Is are considered good concepts, practices, and/or success stories that should continue to be shared. This initial list is intended to be a living list: A process will be developed for reviewing and updating these T&Is.

***511 Traveler Information**—An easy-to-remember three-digit telephone number available to State and local transportation agencies nationwide so that they can readily provide information and highway and transit conditions to travelers by telephone. Travelers can make more informed decisions regarding travel routes and modes, resulting in a more balanced transportation network.
Contact: Bob Rupert, 202–366–2194.

Asset Management Guide—The guide, along with the companion NHI course, illustrates asset-management principles and identifies techniques and methods for adopting the decisionmaking framework in transportation agencies.
Contact: Stephen Gaj, 202–366–1559.
Augered Piles—The technology is characterized by drilling a hollow-stem auger into the ground, forming the diameter of the pile. Sand-cement grout or concrete is pumped into the hole as the auger is being removed from the hole, eliminating the need for temporary casing. After the auger is removed, reinforcement is installed in the pile. For certain applications, these foundation systems can be constructed more quickly and less expensively than can deep foundation alternatives.
Contact: Silas Nichols, 410–962–2460.
Border Wizard—A PC-based software model that accurately simulates all cross-border movements of autos, buses, trucks, and pedestrians, using customs, immigration, and security procedures. It can be used to evaluate and balance policy needs for security and trade efficiency, and address community impacts of improvements and functions at and near borders.
Contact: Mike Onder, 202–366–2639.
***Dispute Resolution Guidance for Environmental Streamlining**—Guidance titled "Collaborative Problem Solving: Better and Streamlined Outcomes for All" is one element of a national dispute-resolution system that presents strategies for interagency collaborative problem solving during the transportation development and environmental review process.
Contact: Ruth Rentch, 202–366–2034.
Expanded Polystyrene (EPS) Geofoam—Lightweight material that can be used as fill behind walls and other support structures. In specific applications, these materials may be required to reduce stress on underlying soils or lateral pressures to retaining walls, abutments, or foundations.
Contact: Peter Osborn, 410–962–0702.
FHWA Traffic Noise Model (TNM), Version 2.1—By improving the ability to predict noise impacts in the vicinity of highways, this model improves the quality of project development decisions. Field efforts would be to assist with the implementation of the FHWA TNM and guide future improvements to the model.
Contact: Bob Armstrong, 202–366–2073.
Highway Economic Requirements System, State Version—A software model that is designed to evaluate the implications of alternative programs and policies on the conditions, performance, and user cost levels associated with highway systems. The model provides cost estimates for achieving economically optimal program structures and predicting system condition and user cost levels resulting from a given level of investment.
Contact: David Winter, 202–366–4631.
Improved Decisionmaking Using Geographic Information Systems—A software program that allows for manipulation, analysis, and display of geographically referenced data. Applications include safety analysis, environmental partnering, asset management, highway inventory attributes, and over-sized truck permitting. The Web site maintained by the Bureau of Transportation Statistics contains numerous examples of how and where this technology has been implemented. The address is: http://www.bts.gov/programs/geographic_information_services/index.html.
Contact: Mark Sarmiento, 202–366–4828.
***Interagency Funding Guidance for Environmental Streamlining**—A resource titled "Interagency Guidance: Transportation Funding for Federal Agency Coordination Associated with Environmental Streamlining Activities" provides transportation and resource agencies with options for using Federal funds to support Federal resource agency coordination for streamlining environmental reviews.
Contact: Ruth Rentch, 202–366–2034.
Intelligent Transportation System (ITS) SpecWizard—A software tool that can help transportation agencies write specifications for the National Transportation Communication for ITS Protocol (NTCIP) standards-based ITS equipment. The user answers ITS questions, and SpecWizard produces a file for incorporation into specifications for NTCIP-based equipment.
Contact: Jason Hedley, 202–366–4073.
Load and Resistance Factor Design and Rating of Structures—An AASHTO Load and Resistance Factor Design and Rating of bridge specification provides for more uniform levels of safety, which should lead to superior serviceability and long-term maintainability.
Contact: Firas Ibrahim, 202–366–4598.

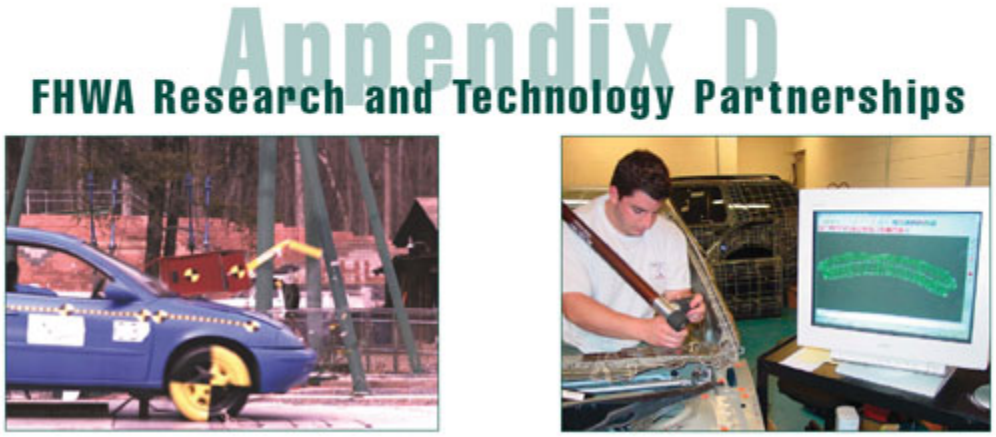
Pavement Smoothness Methodologies—The new pavement smoothness specification covers smoothness test methods, smoothness equipment specifications, and equipment-certification programs. Other components that complement the smoothness specification include an NHI course (131100) on inertial profiler operations, Profile Viewer software, and best practice guides for construction of smooth asphalt and concrete pavements.
Contact: Mark Swanlund, 202–366–1323.
***QuickZone**—A user-friendly computer software tool for estimating and analyzing length of queues and delays in work zones.
Contacts: Scott Battles, 202–366–4372; Deborah Curtis, 202–493–3267.
***"**—The traditional enforcement of violations for running red lights is automated by using camera systems at light-controlled intersections that detect an offending motorist, capture an image of the license plate, and issue a citation by mail.
Contact: Hari Kalla, 202–366–5915.
***Roundabouts**—A circular intersection that requires entering vehicles to yield to existing traffic in the circulatory roadway. Studies show that modern roundabouts can reduce intersection fatalities by up to 90 percent, reduce injury crashes by 76 percent, and reduce pedestrian crashes by 30–40 percent.
Contact: Hari Kalla, 202–366–5915.
***Rumble Strips**—Shoulder rumble strips are continuous grooved indentations in roadway shoulders that provide both an audible warning and a physical vibration to alert drivers that they are leaving the roadway. Studies have shown that these strips yield a significant reduction in run-off-the-road crashes.
Contact: Dick Powers, 202–366–1320.
***Safe Speeds in Work Zones**—Two technologies that can improve work zone safety for highway users and workers. Two technologies that can improve safety in work zones are portable speed limit signs that automatically display safe speed based on traffic conditions and the nature of the roadwork, and feedback displays that show the speed of approaching vehicles.
Contact: Davey Warren, 202–366–4668.
Transportation, Economics, and Land Use System (TELUS)—This information-management and decision-support system helps State DOTs and metropolitan planning organizations (MPO) prepare their annual transportationimprovement programs and Statewide transportation-improvement programs. The system tracks history, schedule, funds expended, budget, and the relationship to other projects.
Contact: Fred Ducca, 202–366–5843.

Technology Implementation Group Approved Technologies

AASHTO created the TIG to identify high-payoff, ready-to-use technologies and to champion the implementation or deployment of these few select technologies, products, or processes that are likely to yield significant economic or qualitative benefits to the users throughout the country. FHWA works closely with and fully supports the AASHTO TIG initiatives and the implementation of the approved TIG technologies. The FHWA Priority, Market-Ready Technologies and Innovations include the following nine approved AASHTO TIG technologies.

Accelerated Construction—This undertaking promotes creative techniques to reduce construction time and enhance quality and safety. This includes techniques and elements along with innovative contracting practices that reduce congestion and enhance quality and safety.
Contact: Dan Sanayi, FHWA, Dan.Sanayi@fhwa.dot.gov.
Air Void Analyzer—The Air Void Analyzer can be used to provide real-time evaluation for measuring air content, specific surface, and spacing factor of fresh PCC. This real-time evaluation can improve quality control. Implementation goals include developing a common standard test protocol, specifications, and a data-collection form.
Contact: John Wiakowski, Kansas DOT, JohnW@ksdot.org.
Fiber-Reinforced Polymer (FRP)—This material can be used to repair cracks in overhead sign supports when the support is wrapped with the fiber-reinforced material. FRP can prevent overhead sign support failure and provide structural integrity to the overhead sign support.
Contact: Paul Wells, New York State DOT, pwells@gw.dot.state.ny.us.

Global Positioning System (GPS) Surveying—The GPS uses satellites that transmit signals continuously; it has many highway applications, including surveying pavement conditions and inventorying highway assets. GPS increases accuracy and reduces labor, time, and costs.
Contact: Charlie Brown, North Carolina DOT, CharlieBrown@dot.state.nc.us.
Ground-Penetrating Radar—Vehicle-mounted ground-penetrating radar can be used to collect information about underlying highway pavement layers without incurring the time and labor costs and traffic delays associated with traditional methods of drilling for core samples. This vehicle-mounted technology collects pavement layer thickness and identifies rapidly deteriorating pavement areas at normal highway speeds.
Contact: Mike Murphy, Texas DOT, mmurphy@dot.state.tx.us.
Highway Rail Warning System—A low-cost active warning system used at low-volume, highway-railroad at-grade intersections. The system consists of locomotive-installed hardware that communicates with the crossing device to activate the signals; it can upload and download data on nearby crossings and report on system operations or health. Most often mounted on standard crossing poles, this technology is solar/battery-powered with wireless communications between the device and the locomotive.
Contact: Dave Huft, South Dakota DOT, dave.huft@state.sd.us.
***ITS Technologies in Work Zones**—The use of ITS technologies in work zones, such as ramp-metering systems, intrusion alarms, and queue-detection information (sensors/cameras), is aimed at increasing safety for workers and road users and ensuring a more efficient traffic flow. These technologies provide ways to better monitor and manage traffic flow through and around work zones, and thus minimize the impact of delays and increase safety.
Contact: Doug Rose, Maryland State Highway Administration, Drose@sha.md.us.
Prefabricated Bridge Elements and Systems—These prefabricated elements and systems may be manufactured on- or offsite, under controlled conditions, and brought to the job location ready to install. These systems minimize traffic impacts of bridge construction projects, improve construction zone safety, make construction less disruptive for the environment, increase quality, and lower life-cycle costs. Using these systems reduces traffic and environmental impacts by minimizing the need for lane closures, detours, and use of narrow lanes.
Contact: Mary Lou Ralls, Texas DOT, mralls@dot.state.tx.us.
Thermal Imaging Safety Screening System—The system allows an operator at a weigh station to view the relative temperatures of brake drums through the wheel rims of commercial vehicles. The infrared image of a correctly operating brake system shows all brake drums to be hot and approximately the same temperature when the vehicle is braking. When a brake is defective, the brake drum appears to be the same temperature as the wheel rim and darker than a properly operating brake. The system was developed using commercial, off-the-shelf components and advanced infrared image acquisition, processing, and storage.
Contact: Gary Hoffman, Pennsylvania DOT, ghoffma@dot.state.pa.us



Appendix D: FHWA Research and Technology Partnerships, 4 photos included: presentation, tour, crash test, lab.

FHWA's research approach emphasizes cooperation, information sharing, and formal development of research agendas, both within USDOT and across the entire government. We promote partnerships with State and local governments, academia, and the private sector to quickly and cost-effectively transform new technologies and concepts into better transportation systems, processes, and services.

Many partnerships may transcend categories, and may often have three or more participants that can represent several categories. The several different partnership types offer many opportunities for participation and involvement in FHWA R&T projects. Partnerships generally can be separated into nine categories (a comprehensive listing of abbreviations can be found in appendix F).

1. **Partnerships with other USDOT agencies:** ITS Joint Program Office (JPO), NHTSA, Federal Transit Administration (FTA), Research and Special Programs Administration (RSPA), Federal Motor Carrier Safety Administration, Federal Aviation Administration, Federal Railroad Administration, Maritime Administration, USCG, and Bureau of Transportation Statistics.
2. **Partnerships with other Federal agencies (outside USDOT):** National Aeronautics and Space Administration, Department of Defense (DOD), Department of Commerce, Department of Energy, Department of State, Environmental Protection Agency, Department of Health and Human Services, Department of Housing and Urban Development, Department of the Interior, U.S. Army Corps of Engineers, U.S. Army Cold Region Research and Engineering Lab, and U.S. Navy.
3. **Partnerships with States or organizations representing States:** AASHTO, LTPP, National Governors' Association.
4. **Partnerships with quasi-governmental organizations:** TRB, NCHRP, and National Science Foundation (NSF).

5. **Partnerships with local governments, MPOs and other organizations representing local and county governments:** National Association of County Engineers, Cities of Los Angeles, CA, and Houston, TX (to evaluate CLAIRE).
6. **Partnerships with universities:** UTCs, Minority Institutes of Higher Education (MIHE), STIPDG, Dwight David Eisenhower Transportation Fellowship Program (DDETFP), National Summer Transportation Institutes for Secondary Students (NSTI), Recycled Materials Research and Technology Product Distribution Center, National Crash Analysis Center (NCAC) at George Washington University.
7. **Partnerships with industry:** Castle Rock Services, Lockheed Martin, Iteris, Mitretek, GEOPAK Corporation, Innovative Pavement Research Foundation (IPRF), SBIR.
8. **Partnerships with nongovernmental organizations:** American Society of Civil Engineers' Civil Engineering Research Foundation, ITE, ITS America.
9. **International partnerships:** International Technology Scanning Program, World Road Association (PIARC), Organization of Economic Cooperation and Development's Road and Transport Research Program (OECD/RTR), European Federation of Highway Research Labs (FEHRL), National Highway Research Council of Canada, United States-Japan ITS Joint Research Program, The Pan American Institute of Highways, The International Road Federation, The Asia Pacific Economic Cooperation Forum, and the French Ministry of Transportation (INRETS).

The following is just a partial listing of different R&T partnerships:

ITS Joint Program Office

The ITS JPO coordinates ITS activities across USDOT, including research, technology, and development conducted at TFHRC.

Research is being conducted at TFHRC on the IVI—a government-industry program coordinated by the JPO. IVI's goal is to use enabling technologies to accelerate development and commercialization of safety-enhancing driver-assistance systems. Partners include FHWA, FTA, NHTSA, RSPA Volpe Center, DOD, and NSF, plus motor vehicle and trucking industries, fleet operators, State and local transportation and law enforcement agencies, emergency response organizations, universities, other research organizations, and professional societies.

The Transportation Pooled Fund Program

When significant or widespread interest is shown in solving transportation-related problems, research, planning, and technology innovation activities and studies may be funded jointly by several Federal, State, regional, and local transportation agencies, academic institutions, foundations, or private industry under the TPF Program. FHWA plays a key role in this process. While FHWA participates and contributes directly to some pooled fund studies, it also encourages States to pool their funds for regional or national problems to avoid research duplication, and to effectively use monies for managing research.

To qualify as a pooled fund study, more than one State transportation agency, Federal agency, other agency (such as a municipality or MPO, college/university, or a private company) must find the subject important enough to commit funds or other resources to conduct the research, planning, and technology innovation activities. A pooled fund study is intended to address a new area, or complement or advance previous subject matter investigations. All studies receive funding from the States involved. Another pooled fund category involves the NCHRP, and every year FHWA establishes a pooled fund study for the NCHRP contributions from the States. Federal and State transportation agencies may initiate pooled fund studies and act as the lead agency for the study. Local and regional transportation agencies, private industry, foundations, and colleges and universities may partner with any or all of the sponsoring agencies to conduct pooled fund projects. The TPF Program is the successor of the former national and regional pooled fund programs.

A new interactive TPF Web site permits online solicitations and funding commitments for new pooled fund studies, and allows lead agencies to post work plans, progress reports, final report/deliverables, implementation activities, and other relevant information. The culmination of an effort to re-engineer the pooled fund program, the Web site serves as the central communications tool for tracking the status of pooled fund studies. Workshops on the program and demonstrations of the Web site were held at each of the 2003 regional AASHTO RAC meetings. The Web site is located at http://www.pooledfund.org/. For more information about the program, contact Lisa Williams, TPF Coordinator, at 202–493–3376.

Small Business Innovation Research Program

The SBIR program is an R&D program mandated by Congress in 1982 and reauthorized in 1992. Its purpose is to develop technological innovations by using high-level expertise in the small-business community throughout the United States. The program aims to stimulate technological innovations; meet the Federal Government's needs for R&D by providing opportunities to small businesses; increase private-sector commercialization of innovations derived from Federal R&D; and provide opportunities for minority and disadvantaged participation in technological innovations.

One example of an SBIR research partnership is the Visual Freight Database, which is a public/private partnership that provides improved modeling tools for national, State, and MPO freight planning and information that shows county-to-county freight movements by modes and commodity types. The database is available for use throughout FHWA.

International Involvement

FHWA promotes the U.S. highway transportation community's objectives through participation in international organizations and their operating committees, including the Pan American Institute of Highways, the PIARC, the OECD/RTR program, the International Road Federation, and the Asia Pacific Economic Cooperation Forum.

FHWA also fosters cooperation on international R&T activities with such U.S. partners as AASHTO and NCHRP. The International Technology Scanning Program accesses and evaluates foreign technologies and innovations that might significantly benefit U.S. highway transportation systems. This program enables advanced technology to be adapted and implemented much more efficiently without spending scarce research funds to recreate advances that already have been developed by other countries. Twelve scans are conducted over a 2-year period. Additionally, FHWA has a number of bilateral agreements with other countries.

The RD&T Office of Infrastructure represented FHWA at the PIARC Road Pavement Committee meeting in Paris, France, April 2003. An FHWA-led effort helped develop the PIARC Guideline for Pavement Type Selection. FHWA also shared its experience and successes in implementing pavement innovations into practice (such as Superpave and Ultra-Thin Whitetopping).

FHWA and the French Road Directorate (Direction des routes) signed a project agreement on highway research and T2 that falls under the INRETS/USDOT Memorandum of Understanding framework, signed February 14, 1972. Our agreements are indefinite unless one party chooses to terminate the partnership.

One effort under our continuing agreement with France involved the research and testing of a product called CLAIRE, an expert decisionmaking system for real-time traffic management. This led to agreements for working together to field test a combination of FHWA and French-developed software in Los Angeles, CA's and Houston, TX's urban environments.

Efforts also are underway to create an R&T partnership with the FEHRL. Frequently, the United States and European Union (EU) research priorities are similar; therefore, a partnership with FEHRL helps save

money by avoiding duplication of effort and allows optimal use of resources. FHWA will be working with FEHRL to conduct EU-supported research. This cooperation may allow for future common standards.

The tenth United States-Japan Workshop on Advanced Technology and Highway Engineering was held in Salt Lake City, UT, and Seattle, WA, in November 2002. The workshop focused on transportation systems management and operations, with an emphasis on special events management and lessons learned from the Winter Olympics. The workshop was co-hosted by FTA and Utah State DOT. It was the final workshop held under the 1997 Implementing Arrangement on Highway Cooperation between FHWA and the former Japanese Ministry of Construction. That agreement expired in January 2003. Future cooperation will take place under the comprehensive United States-Japan Transportation Implementing Arrangement in Science and Technology signed in 1994 between USDOT and the Japanese Ministry of Land, Infrastructure, and Transport.

An agreement was made with Japan to proceed with a United States-Japan ITS joint research program for developing infrastructure cooperative systems to avoid intersection collisions. This involves a continuing, cooperative dialogue on specific research of common interest by routine communication through our Japanese research fellow and annual workshops. Yoshiteru Iwami from the Japanese Ministry of Land, Infrastructure, and Transport joined Operations R&D in May 2003 on a 1-year International Research Fellowship sponsored by the United States-Japan ITS Joint Research Program.

Concrete Pavement Technology Program (CPTP)

Launched in 1999, the CPTP is a 5-year, $25 million effort that was charged by TEA-21 with carrying out "research on improved methods of using concrete pavement in the construction, reconstruction, and repair of Federal-aid highways." FHWA and the IPRF, a concrete paving industry consortium, jointly administer the program. The program's partners also include State highway agencies and TRB. Specifically, the partnership will ensure that the highest priority concrete pavement technology needs are addressed; the expertise and resources of States, industry, and FHWA are used effectively and efficiently; and new concrete pavement technology will proceed rapidly from research to implementation.

In addition to the oversight provided by FHWA and the IPRF, the program receives guidance from the TRB Committee for Research on Improved Concrete Pavements. The committee reviews and provides advice on the program's long-range work plan and project tasks, including objectives, appropriateness, and the likelihood of success. The committee has representatives from industry, academia, State highway agencies, FHWA, IPRF, and AASHTO.

Federal Highway Administration/National Highway Traffic Safety Administration/National Crash Analysis Center

FHWA, NHTSA, and George Washington University broke ground for a new crash test facility located at the university's Virginia campus. Scheduled for opening in 2005, the new facility will include indoor highway and infrastructure safety testing labs and an automotive crash test barrier. The event was also marked by the commemoration of the 10-year partnership among FHWA, NHTSA, and George Washington University at the NCAC.

The NCAC's highway infrastructure safety research supports the research at TFHRC in McLean, VA, and has resulted in lifesaving innovations in highway technology. NCAC research has helped improve over a dozen roadside hardware devices, such as guardrails, signposts, and lighting towers.

Appendix E
FHWA Educational Outreach Partnerships

Appendix E FHWA Educational Outreach Partnerships, photo of TFHRC building.

To encourage a new generation of transportation professionals, TFHRC annually gives hundreds of students the opportunity to learn firsthand about the career options available in transportation research. Outreach programs with local schools and active participation in such programs as the Garrett A. Morgan Technology and Transportation Futures Program, a USDOTwide initiative, provides opportunities to increase awareness of transportation and related skills among children and adults. Since its inception in 1997, the program has increased awareness of math, science, and transportation technology for 2 million children and young adults. Programs like this one find and develop our future workforce.

Dwight David Eisenhower Transportation Fellowship Program

DDETFP, initiated in 1991 and reauthorized by the TEA-21, awards fellowships to undergraduate, graduate students, and faculty annually. The program will award $24 million by 2003 to prospective transportation professionals. Fellowship categories are: Grants for Research; Graduate; Faculty; Historically Black Colleges and Universities (HBCU); Hispanic Serving Institutions; and Tribal Colleges.

Minority Institutes of Higher Education

One of FHWA's goals is to strengthen the ties between the RD&T program and MIHEs. There are several ways of achieving this goal. For example, we provide research grants and offer summer employment opportunities for MIHE faculty and students. This fosters MIHE RD&T activities that contribute substantially to FHWA's mission and prepare faculty and students at MIHEs to participate successfully in the competitive research arena.

The National Highway Institute

NHI, FHWA's technical training organization, develops and administers transportation-related training and educational programs that support new technology applications for planning, designing, constructing, maintaining, operating, and rehabilitating our Nation's transportation infrastructure. NHI offers training to Federal, State, and local transportation agencies, and increasingly, to the private sector. NHI provides

technical course materials for inclusion in undergraduate and graduate curricula, and collaborates with community colleges, technical schools, and secondary and grade schools to identify the transportation professionals of tomorrow.

The National Summer Transportation Institutes for Secondary Students

The NSTI offers a 4-week introduction to all modes and careers in transportation as well as academic enhancement activities. The on-campus sessions are designed to encourage a diverse cadre of motivated middle- and high-school students to pursue transportation careers and to address the need for a welltrained, qualified, diverse workforce in the 21st century. To date, the NSTI host sites include HBCUs and other minority institutions of higher education across the Nation, with South Carolina State University serving as the Institutes' National Research and Technology Product Distribution Center. FHWA celebrated the 10-year anniversary of the program in May 2003, and announced two new goals for the program. Under the FHWA plan, NSTI programs, which are now in 26 States, plus the District of Columbia and Puerto Rico, would be established in all 50 States. In addition, the Agency would like to increase to 10,000 the number of secondary school students introduced to the transportation industry and transportation-related careers. Both goals are to be achieved in the next 5 years.

The Summer Transportation Internship Program for Diverse Groups

Since 1991, the USDOT headquarters has provided 10-week summer college-level STIPDG internships. In 1999, it expanded to include field office placements for a maximum of 100 students each year. In 2003, we employed 2 STIPDG students at TFHRC for 60 days, one from Texas Southern University and the other from the University of Wisconsin. We also hosted a briefing and tour for the entire program class of 97 interns.

University Transportation Centers Program

The UTC Program funds 26 universities, including consortia representing more than 70 colleges and universities, to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and T2 at university-based centers of excellence. Each UTC is required to meet TEA-21-mandated program goals in transportation research, education, and workforce development, and T2 as part of the terms of the UTC grant. The UTC Program is authorized $227.8 million in funding over the 6-year authorization period of TEA-21. FHWA, along with FTA, transfers funds to RSPA's Office of Innovation, Research, and Education, which administers the program in coordination with FHWA. FTA, and other interested USDOT administrations. The *University Transportation Education Resource Catalog* provides information on USDOT and FHWA educational initiatives, along with Web site links to transportation-related opportunities.

Universities and Grants Programs (U&GP)

FHWA supports a number of key initiatives under the U&GP, which is funded separately from the RD&T program. The mission of the U&GP is to promote transportation education benefits and encourage transportation research pursuits among university students and faculty. The U&GP program works cooperatively with more than 750 universities throughout the United States. Its primary objectives are to enhance FHWA university-based programs and other academic programs that provide fellowships, internships, and partnerships; conduct workforce analyses related to retention, recruitment, and diversification; and conduct research on USDOT's and FHWA's transportation-related academic programs to promote transportation education benefits and encourage transportation research pursuits among university students and faculty.

Appendix F
Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ACS	Adaptive Control Systems
ATIS	Advanced Traveler Information System
CLAIRE	Expert decision software for real time traffic management developed in France
CMP	Corporate Master Plan
CMS	Corporate Management Strategies
COST	Concrete Optimization Software Tool
COTR	Contracting Officer's Technical Representative
CPTP	Concrete Pavement Technology Program
CRCP	Continuously Reinforced Concrete Pavements
DDETFP	Dwight David Eisenhower Transportation Fellowship Program
DOD	Department of Defense
DOT	Department of Transportation
DynaMIT	Prototype for the Real-Time Traffic Estimation and Prediction System (TrEPS)
DynaMIT-P	Prototype for the Traffic Estimation and Prediction System for Operations Planning
DYNASMART-P	Prototype for the Traffic Estimation and Prediction System for Operations Planning (TrEPS-P)
DYNASMART-X	Prototype for the Real-Time Traffic Estimation and Prediction System
EA	Environmental Assessments
EIS	Environmental Impact Statements
ETG	Expert Task Group
EU	European Union
FEHRL	European Federation of Highway Research Labs
FHWA	Federal Highway Administration
FOIL	TFHRC Federal Outdoor Impact Laboratory
FRP	Fiber-reinforced Polymer
FTA	Federal Transit Administration
FY	Fiscal Year
GIS-T	Geographic Information Systems Decisionmaking Software
GPS	Global Positioning System
HAAM	FHWA Office of Acquisition Management
HA-NDGPS	High Accuracy Nationwide Differential Global Positioning System
HBCU	Historically Black Colleges and Universities
HIPERPAV	High-Performance Paving Software
HITEC	Highway Innovative Technology Evaluation Center
HMA	Hot-mix Asphalt
HPC	High-Performance Concrete
HPS	High-Performance Steel

HRDI	FHWA Office of Infrastructure R&D
HRDO	FHWA Office of Operations R&D
HRDS	FHWA Office of Safety R&D
HRPD	FHWA RD&T Office of Program Development
HRRM	FHWA RD&T Office of Resource Management
HRTS	FHWA RD&T Office of Research and Technology Services
HSIS	Highway Safety Information Systems
HYRISK	Software for Inspecting Bridges
IDEA	Innovations Deserving Exploratory Analysis
IPRF	Innovative Pavement Research Foundation
IHSDM	Interactive Highway Safety Design Model
INRETS	French Ministry of Transportation
IT	Information Technology
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
IVI	Intelligent Vehicle Initiative
JCP	Jointed Concrete Pavements
JPO	Joint Program Office
K-12	Kindergarten through Senior High School
KGM	Turkish Highway Agency
Labs	Laboratories
LADS	Learning and Development System
LED	Light Emitting Diode
LIFE	Long-lasting highways using Innovative technologies and practices to accomplish Fast construction of Efficient and safe pavements and bridges
LRFD	Load Resistance Factor Design
LTPP	Long Term Pavement Performance
MIHE	Minority Institutes of Higher Education
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NBI	National Bridge Inventory
NCAC	National Crash Analysis Center
NCHRP	National Cooperative Highway Research Program
NHI	National Highway Institute
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
NSGM	Near-Source Ground Motion
NSTI	National Summer Transportation Institutes
NTCIP	National Transportation Communication for ITS Protocal
OECD/RTR	Organization of Economic Cooperation and Developments Road and Transport Research Program
OMB	Office of Management and Budget
OST	Office of the Secretary of Transportation

PART	Program Assessment Rating Tool
PBCAT	Pedestrian and Bicycle Crash Analysis Tool
PCC	Portland Cement Concrete
PCCP	Portland Cement Concrete Pavement
PDP	Professional Development Program
PIARC	World Road Association
QuickZone	Work Zone Delay Estimation Software
R&D	Research and Development
R&T	Research and Technology
RAC	AASHTO Research Advisory Committee
RD&T	Research, Development, and Technology
RPC	Reactive Powder Concrete
RSPA	Research Special Programs Administration
RTCC	Transportation Research Board's Research and Technology Coordinating Committee
SAFETEA	Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003
SBIR	Small Business Innovation Research
SHRP	Strategic Highway Research Program
SOW	Statement of Work
STIPDG	Summer Transportation Internship Program for Diverse Groups
Superpave®	SUperior PERforming Asphalt PAVEment System
SWAT	Strategic Work Zone Analysis Tools
T2	Technology Transfer
T&I	Technology and Innovation
TEA-21	Transportation Equity Act for the 21st Century
TFAP	Technology Facilitation Action Plan
TFHRC	Turner-Fairbank Highway Research Center
TIG	AASHTO Technology Implementation Group
TMC	Transportation Management Center
TNM	Traffic Noise Model
TRB	Transportation Research Board
TReL	Traffic Research Laboratory
TPF	Transportation Pooled Fund
TSIS	Traffic Software Integrated System
TT	Technology Talks newsletter
U&GP	Universities and Grants Program
UHPC	Ultra-high performance concrete
USCG	United States Coast Guard
USDOT	United States Department of Transportation
USLIMITS	Preliminary Expert System for Speed Zoning
UTC	University Transportation Center
Web-NBI	Web-based National Bridge Inventory system
WIM	Weigh-in-motion