Collaboration on Highway R&D To Address New Technologies

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Research programs have historically been a building block for combining experience and innovative ideas to produce new technologies. To ensure that the technologies will actually meet user needs, many research administrators are promoting cooperative research efforts. The move toward collaboration is increasingly evident among members of the highway community. Presented here are a brief historical account of highway research administration and a description of two efforts aimed at developing and distributing new highway technologies through collaborations of government, industry, academia, and other entities.

Administration of Highway Research

The need for a national program of cooperative highway research was addressed in the early part of this century through the Highway Research Board, now the Transportation Research Board (*1*). The objective of the program was to coordinate activities in industry, academia, and other organizations for the dissemination of research findings. From the pre-World War II years through the early 1960s, the emphasis was on experiments and experience with materials, pavement design, and road safety. Many current criteria and guidelines in these areas were established on the basis of field experience and the results of successful experiments.

In the late 1960s, a study by the American Association of State Highway Officials on better ways to implement research results increased the federal government's interest in highway research. In the early 1970s, the Federal Highway Administration established the Implementation Division in its Office of Development. The division's primary objective was stimulating and expanding the application of the products of highway research and development. This objective was achieved through the interjurisdictional use of FHWA research findings in a process similar to technology transfer among states. The administration's technology transfer specialists coordinated implementation activities at the regional and division levels, often through personal contact, to ensure that technologies were being developed with practical applications in mind. These duties were assumed by the Office of Technology Applications in the 1990s.

FHWA receives assistance with its implementation activities from three committees. TRB's Research and Technology Coordinating Committee provides guidance to the administration's research and technology program by supplying an independent assessment of highway research opportunities and priorities. AASHTO's Research Advisory Committee collects information on research in progress at state departments of transportation. And the association's Standing Committee on Research helps to identify research needs and distribute funds to meet these needs.

FHWA plays a significant role in revitalizing the domestic economy by improving the U.S. transportation system through highway research, development, and technology transfer. In 1990 the administration defined a marketing process through which highway research and technologies could be more effectively developed, promoted, implemented, and deployed. The process hinges significantly on the incorporation of user needs into the development of new research products.

Technologies developed by state departments of transportation are often implemented only in a single or a few states because of limited resources (2). In 1992 FHWA's Office of Technology Application initiated a 3-year study to develop a mechanism to identify innovative technologies with potential for nationwide use. The study focused on technologies in five technical areas: asphalt pavements, concrete pavements, structures, traffic safety, and traffic operations. (Technologies associated with the Intelligent Vehicle Highway System and the Strategic Highway Research Program were not included.)

A research team met with representatives of state transportation departments, transportation associations, and universities to examine successful technology development efforts. Team members studied the test results, performance evaluations, and cost data of each of the technologies selected for review with agency researchers. Finally, each research team compiled institutional reports on the technologies.

The Office of Technology Applications then asked panels of experts in each of the five research areas to review the reports. Panel members assessed and ranked the technologies under examination on the basis of six criteria: feasibility, applicability, implementability, expected effectiveness, possible trade-offs, and cost. Data on the technologies receiving the highest rankings were presented to FHWA for distribution to other transportation agencies and packaging as new technologies worthy of consideration (Table 1).

Highway Innovative Technology Evaluation Center

In 1989 the American Society of Civil Engineers created the Civil Engineering Research Foundation (CERF) to expedite the movement of research from

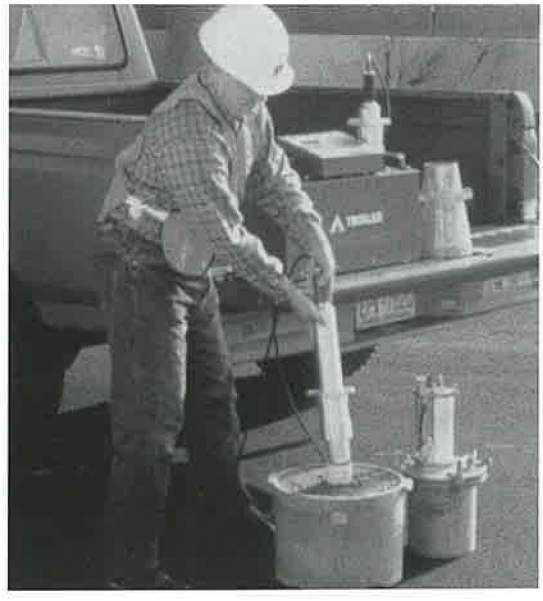
TABLE 1 Technologies Identified by FHWA As Having Potential for Nationwide Use

Research Areas	Technology Sponsors
Asphalt Pavements	
Asphalt Content Determination by Ignition	National Center for Asphalt Technology
Pavement Distress at Intersections	University of Kentucky Transportation Center
Georgia Loaded Wheel Tester and Rolling Compactor	Georgia Department of Transportation
Concrete Pavements	
Use of Maturity Meter for Quality Control of Concrete	Texas Transportation Institute
Petrographic Examination of Concrete	Arkansas State Highway and Transportation Department
Quality Assurance, Quality Control Specifications	New Hampshire Department of Transportation
Structures	
Metric I-Shaped Girder	University of Nebraska
Composite Prestressing Cables	South Dakota School of Mines and Technology
Instrument for Non-Destructive Evaluation of Axially Loaded Bridge Members	West Virginia University
Safety	
Bull Nose 3F Median Barrier End Treatment	Colorado Department of Transportation
Personal Computer Accident Location Analysis System	Iowa Department of Transportation
Tyler Zero Velocity Salt/Sand Spreader	Minnesota Department of Transportation
Traffic Operations	
Comprehensive Planning Study of Maintenance Facilities for Connecticut Department of Transportation	University of Connecticut
Evaluation of Removal of Unwarranted Traffic Signals	Mississippi Department of Transportation
Gravel Shoulder Reclaimer	Minnesota Department of Transportation

universities and laboratories into practice and to promote the adoption of innovative technologies throughout the engineering and construction industry (3). To fulfill this mission and avoid the duplication of activities among civil engineering-related organizations, the foundation serves as a facilitator, coordinator, and integrator of research efforts.

Since its inception, CERF has launched a variety of collaborative programs focusing on innovation. One of these initiatives is the Highway Innovative Technology Evaluation Center (HITEC). Created in 1992 through a 4-year cooperative agreement between CERF and FHWA, the center has evolved into a first-stop service center for performance-based technology evaluations, which are used in the creation of standards for innovative highway products. The center is known for its collaborative approach in expediting the introduction of innovative technologies into the highway and bridge market. This approach is modeled on that of the Transportation Research Board's National Cooperative Highway Research Program. Volunteers from TRB committees are actively involved in HITEC activities.

The center has worked closely with AASHTO's National Transportation Product Evaluation Program to ensure that the activities of the center and those of the program complement rather than duplicate each other. The HITEC staff assess technologies that are market-ready but cannot be evaluated by existing standards or specifications, whereas AASHTO's program focuses on products that can be tested in laboratory settings against the testing protocols of AASHTO, ASTM, or both.



TROXLER ELECTRONIC LABORATORIES

Water-cement gauge for on-site verification of proper concrete mixing is prepared for demonstration at Wheaton, Maryland, metro station. Highway Innovative Technology Evaluation Center panel of public- and private-sector experts in concrete technology evaluated device.

HITEC also acts as an official clearinghouse for the Applied Research and Technology Program, which is funded through the Intermodal Surface Transportation Efficiency Act. Typically, a private-sector company with a product that meets the eligibility criteria partners with the center and a public agency to evaluate the product. Subject to FHWA approval, applied research and technology funds can be used to cover some or all of the costs required for testing and evaluating the technology in a demonstration project. In this way, risks and rewards are spread between the public and private sectors, creating a win-win situation for all parties involved.

As HITEC has evolved, it has sought new opportunities to collaborate with government, industry, and academia to accelerate the introduction of new technologies into the marketplace. Although the center was established primarily to accept applications from the owners of technologies, public agencies are also encouraged to seek assistance, when appropriate, in evaluating a generic group of technologies. Assessments of seismic isolation and energy dissipation devices for bridges, proprietary retaining walls, fiber-reinforced plastics for retrofitting and strengthening bridges, and other technologies have been undertaken.

Through continued coordination, state departments of transportation and technology transfer centers nationwide will ensure that the center's reports, the end result of its services, will be widely disseminated. Most important, the new technologies and products evaluated will gain rapid acceptance in the marketplace.

U.K. Technology Foresight Programme

In the United Kingdom, the 1993 *White Paper on Science, Engineering, and Technology,* which stressed the need for partnerships among the scientific, engineering, and technology-development communities, is changing the context within which transportation research is conducted and organized (4). The paper's recommendations are affecting not only the long-term and high-level issues of how best to appraise national research but also the day-to-day issues of how researchers, and the various bodies involved in the conduct and application of research, interact with each other and formulate and present their proposals.

The establishment and main features of the British government's Technology Foresight Programme, which provides a framework for coordinating long-term research priorities, are described in the white paper. Previously, reviews of research

directions in the United Kingdom had been undertaken on an ad-hoc basis. As a result of the white paper, all research councils, including the transportation research council, were charged with drafting mission statements that place special emphasis on identifying user communities, meeting the needs of these communities, and ensuring that the mission to promote and support high-quality research and related postgraduate training embraces strategic and applied research as well as basic research. These requirements, which are set within the context of "enhancing the United Kingdom's industrial competitiveness and quality of life," are symptomatic of new expectations of those commissioning, undertaking, and using research, with the intention of "developing stronger partnerships with and between the science and engineering communities, industry, and the research charities." The goal is to establish a greater "coincidence of purpose" among academia, industry, government, and other key entities to ensure that research resources are harnessed for the national good.

The Technology Foresight Programme is envisioned as a means for forging a new working partnership of scientists, engineers, economists, financiers, businessmen, industrialists, and civil servants to assess the significance of emerging technological trends and market opportunities. In the preparatory stages of the program, a panel for each of 15 industrial sectors was convened. The transport panel noted that new transportation technologies exist but that too little attention is being paid to creating markets for them. Therefore the challenge is to catalyze market momentum and target actions to overcome barriers to market developments. The panel concluded that the most cost-effective way to meet this challenge would be to create a series of transport foresight projects aimed not at the development but at the application of particular technologies. These projects would require cooperative action by government and industry in a public-private partnership.

Meeting User Needs

To incorporate innovation into the highway research process, the traditional focus on products must shift to a focus on users, that is, the highway community. All efforts to find practical solutions to highway problems through research, and to ensure that these solutions are implemented, should be made in reference to the needs of the highway community. Ultimately, the successful application of innovative research techniques depends on the involvement and support of partners in this community, which helps shape the country's transportation system.

RESEARCH CONTRACTING
Another Form of Partnering

Many state departments of transportation rely on staff or research councils to develop research programs. But more than half of these programs are actually performed by universities, many using basic agreements or pooled-fund contracts. Along with private consultants and other contractors, universities account for the expenditure of 82 percent of research funds and the conduct of 58 percent of the states' transportation research.

Most so-called soft-side transportation research, including nearly all research related to the environment and traffic control, and approximately one-half to three-fourths of research related to materials and construction, is performed by universities and consultants. By contracting this research, state departments of transportation can concentrate on so-called functional research. At the same time, they can take advantage of other expertise in the field and build firm relationships with universities and other research organizations.

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