

COOPERATIVE RESEARCH PROGRAMS BENEFIT STATE TRANSPORTATION DEPARTMENTS AND PUBLIC TRANSIT AGENCIES

TRANSPORTATION RESEARCH BOARD

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The Transportation Research Board manages two cooperative research programs: the 35-year-old National Cooperative Highway Research Program (NCHRP) and the 5-year-old Transit Cooperative Research Program (TCRP). Each program is a partnership of users of its findings, the federal government, and the Transportation Research Board, and each emphasizes applied research of immediate and practical benefit to its constituencies.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Since 1962 the National Cooperative Highway Research Program has provided a valuable service and unique opportunity to state departments of transportation. Through the American Association of State Highway and Transportation Officials, and with the cooperation of the Federal Highway Administration, these departments annually recommend and finance the program's research. This research has been the basis of specifications, design methods, and AASHTO codes as well as of testing guidelines for product evaluation. Although state departments of transportation are the primary users of the research findings, the national and international transportation industries have also put the findings to use.

The idea of a cooperative highway-research effort was conceived in 1959 by leaders represent-

ing the American Association of State Highway Officials (AASHO), now the American Association of State Highway and Transportation Officials, and the Bureau of Public Roads, now the Federal Highway Administration. At the time, duplication of research efforts among states was a serious concern. Pooling state funds in a cooperative research program directed at common problems offered obvious advantages. The Highway Research Board, now the Transportation Research Board, was chosen to administer the program because of its track record in managing the AASHO Road Test and because of its recognized objectivity and prominent position in highway research. In addition, the board could readily obtain advice on transportation-related subjects from the reservoir of professional expertise within the National Research Council, the operational arm of the National Academy of Sciences, a private, nonprofit research institution. In 1962 a three-way agreement to inaugurate the National Cooperative Highway Research Program was signed by the National Academy of Sciences, the American Association of State Highway Officials, and the Bureau of Public Roads.

Each year's program is selected from problem statements collected from the AASHTO member departments and committees and from FHWA. Following screening and evaluation, the projects selected by the AASHTO Standing Committee on Research must be approved by no less than two-thirds of the members of the association's board

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of directors before being referred to TRB for acceptance and incorporation in the annual program.

Financial support for the NCHRP is obtained each year, when state departments of transportation are asked to voluntarily contribute 5.5 percent of their State Planning and Research (SP&R) funds. Since 1962 these departments have consistently supported the program with the exception of a few years when one or two states were unable to contribute. For the past 12 years, every state has contributed to the program. Program funding rises or falls in direct proportion to the level of SP&R funding in a given year. In fiscal year 1997 contributions to the program totaled \$17.7 million.

Most program research addresses either emerging issues or focuses on refinements of existing practice. Frequently, the products of the research are manuals, standards, or guidelines adopted by the American Association of State Highway and Transportation Officials, state highway departments, and other organizations. Currently, more than 117 products are being developed for AASHTO's 19 committees. Research results are for the most part published in the NCHRP series of reports. However, some results are transmitted directly to AASHTO or are made available as contract-research agency reports.

The credibility of the program's research depends a great deal on the ability of technical professionals to reach consensus. TRB appoints a panel of experienced practitioners and research specialists to provide technical guidance throughout the life of each project. The panels request proposals and select contractors based on an evaluation of those proposals. Emphasis is placed on the appointment of panel members who represent the intended consumers of the research product. Accordingly, more than one-half of the 1,100 individuals currently serving on NCHRP panels are employed by state departments of transportation.

NCHRP products that have been adopted and are in widespread use include the *Highway Capacity Manual*, the *AASHTO Guide for Design of Pavement Structures*, the *AASHTO Manual of Subsurface Investigation*, major portions of AASHTO's *A Policy on Geometric Design of Highways and Streets* (commonly called the Green Book), the *AASHTO Guidelines on Bridge Management Systems*, the *AASHTO Guidelines on Pavement Management Systems*, and the *AASHTO Guide on Metric Conversion*. NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, is referenced by the Federal Highway Administration as the standard for evaluating the safety performance of various highway features.

In 1995 AASHTO adopted new bridge-design specifications on the basis of the results of a major NCHRP project. The association's bridge specifications are, once again, considered to be the most comprehensive and up to date of their kind.

Although not officially recognized, some NCHRP research results have become de facto industry standards. Report 244, produced more than 15 years ago, is still used by many state departments of transportation and manufacturers for qualifying concrete sealers. Other reports have been used for guidance on a variety of topics: quick-response techniques for estimating urban travel (Report 187), removal of lead paint from bridges (Report 265), systems for reinforcing earth (Report 290), methods for dealing with hazardous waste sites (Reports 310 and 351), and geographic information systems (Report 359).

A special NCHRP function is the preparation of state-of-the-art or -practice reports. Syntheses of relevant research and innovative practice, the reports are a valued source of information on the ways in which state and other transportation agencies operate or respond to various challenges. The Synthesis of Highway Practice series is popular among state departments of transportation.

Legal issues are the subject of another series of reports prepared through the program. The Legal Research Digest series contains summaries of case law highlighting issues and indicating trends of interest not only to lawyers but to transportation practitioners.

Since 1993 the NCHRP-Ideas Deserving Exploratory Analysis (IDEA) program has been administered through the National Cooperative Highway Research Program. Funded primarily by FHWA, the program provides assistance to researchers or entrepreneurs with innovative concepts or products that will benefit the transportation industry.

Current NCHRP projects focus on a wide range of issues, some of which are described below.

Safety

An increasingly diverse vehicle fleet, growing numbers of older drivers, and a decline in motorist compliance with traffic regulations pose roadside safety risks. In April 1995 a project was initiated to develop a plan for research to reduce these risks. A panel of top professionals has been assembled to provide technical guidance, and a final plan is expected by September 1997.

Pavement Design

A new *AASHTO Guide for Design of New and Rehabilitated Pavement Structures* is being developed. The objective of the project is to bring

together the best existing knowledge about the design of pavement structures into a single, comprehensive document. The guide will be recommended for adoption in 2002.

Economics

The importance of transportation to economic well-being and development is often overlooked and needs to be better articulated. To remedy this problem, a report of case studies on transportation investment and economic expansion has been prepared. The report, distributed by AASHTO, is a summary of ways in which transportation investment can support such expansion. Another project has resulted in the development of "StratBENCOST" software, in which user-cost estimation procedures are applied to transportation planning. Testing and verification of the software are under way.

Financing

Recently published NCHRP Report 377, *Alternatives to Motor Fuel Taxes for Financing Surface Transportation Improvements*, contains recommendations for evaluating transportation-finance alternatives along with general assessments and future expectations and trends. A follow-on study to examine taxation of heavy vehicles is under way.

SHRP Follow-On Studies

Follow-on work to the Strategic Highway Research Program continues, primarily on issues affecting the Superpave system for asphalt/aggregate mixture design and analysis. Work has begun on tests or refinements to tests on reclaimed asphalt, modified asphalt binders, water sensitivity, and compaction using a gyratory device. Research on quality-control/quality-assurance field procedures and equipment for implementing the Superpave mix-design method is in the final phase.

Highway Capacity Manual

A project to organize and coordinate the update of the *Highway Capacity Manual* has been initiated. Work has begun under the leadership of the contractor and guidance of an NCHRP panel.

Quality Assurance and Quality Control

A trend in the operation of state departments of transportation is to do more with less. Consequently, the departments are reevaluating their inspection and testing requirements for the construction of highway facilities. States are trying to determine the appropriate split between the quality control being done by contractors and the

quality assurance done by themselves as well as determine the effectiveness of this split. This issue is being examined in the context of quality control and quality assurance of asphalt overlays and pavements. A new project will focus on the use of quality in prequalifying bidders and as a factor in the bid selection process.

Environmental Research

Recommended guidelines for the development of wetland replacement areas have been published as NCHRP Report 379. The guidelines will assist in the design, construction, and maintenance of replacement wetlands. In addition, a set of guidelines for sealing geotechnical exploratory boreholes has been published as NCHRP Report 378. Sealing is required in many instances to avoid the contamination or loss of groundwater. Other research focuses on water quality, the use of waste and recycled material in construction, and particularly air quality. Approximately \$5.5 million in research funds is being used to study vehicle emissions, the implementation and effects of transportation-control measures, and the modeling of carbon monoxide emissions.

Multimodal Transportation Planning

A significant amount of research continues to be devoted to planning for the efficient movement of people and goods by all transportation modes. Recently completed studies resulted in a reference report for forecasting changes in freight transportation demand and guidance on innovative practices for multimodal transportation planning. Other aspects of multimodal transportation planning are being examined.

Segment of Route 7, near Leesburg, Virginia, where draft quality-control/quality-assurance field procedures for implementing Supervave mix-design method were first tested. Procedures were developed under National Cooperative Highway Research Program Project 9-7, Field Procedures and Equipment to Implement SHRP Asphalt Specifications.



BRENT RAUHUT ENGINEERING

COOPERATIVE RESEARCH PROGRAMS ON THE INTERNET

The Cooperative Research Programs (CRP) Division of TRB announces a new home page for the National Cooperative Highway Research Program (NCHRP) and the Transit Cooperative Research Program (TCRP). The site is located on the World Wide Web at <http://www2.nas.edu/trb/crp>. Features include

- Information on the history, mission, and procedures of the two programs;
- Information on the objectives and status of all research projects of the programs since 1988, project statements (requests for proposals), and anticipated projects;
- Easy-to-use search engine;
- Form for submitting problem statements to TCRP;
- Registration form for receipt of electronic notification of requests for proposals; and
- Form for documenting those successes for which CRP projects have laid the foundation.

Comments and recommendations concerning the site can be sent to rderr@nas.edu. Publications resulting from NCHRP and TCRP projects may be ordered on line at <http://www2.nas.edu/trbbooks>.

TRANSIT COOPERATIVE RESEARCH PROGRAM

The Transit Cooperative Research Program, modeled after the National Cooperative Highway Research Program, makes use of an independent, industry governing board and expert panels to define and oversee each research activity. The program focuses on issues significant to the transit industry with emphasis on the development of near-term solutions to a variety of transit problems involving operations, service configuration, equipment, facilities, maintenance, human resources, administration, and planning. The need for the Transit Cooperative Research Program was originally identified in TRB Special Report 213, *Research for Public Transit: New Directions*. A report by the American Public Transit Association, *Transportation 2000*, also recognized the need for local, problem-solving research. The Transit Cooperative Research Program was subsequently authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991.

The program was established under Federal Transit Administration sponsorship by memorandum agreement in 1992. This agreement outlining the program's operating procedures was executed by three cooperating organizations: the Federal Transit Administration, the National Academy of Sciences acting through the Transportation Research Board, and the Transit Development Corporation, a nonprofit educational and research organization

established by the American Public Transit Association. The program is funded through a grant, averaging \$8.3 million annually, from the Federal Transit Administration. Representatives of the transit industry select the research, thereby ensuring its relevance and usefulness.

In less than 5 years TCRP has produced significant benefits through studies aimed at supporting new standards, guidelines, and recommendations for practitioners. A manual on transit capacity and quality of service, now being prepared, will provide the transportation industry with standard analytical methods. Report 13, *Rail Transit Capacity*, provides much of the material needed for the rail portion of an upcoming transit capacity manual.

Other guidance documents include Report 5, *Guidelines for Development of Public Transportation Facilities and Equipment Management Systems*, which is intended to assist states to develop the management systems outlined in the Intermodal Surface Transportation Efficiency Act of 1991, and Report 8, *The Quality Journey: A TQM Roadmap for Public Transportation*, which provides direction for implementing total quality management in a public transit agency. Three additional important guidance documents are Report 12, *Guidelines for Transit Facilities Signing and Graphics*; Report 18, *A Handbook for Acquiring Demand-Responsive Software*; and Report 19, *Guidelines for the Location and Design of Bus Stops*.

Select results of TCRP studies and the ways in which they are being used are described below.

Low-Floor, Light-Rail Vehicles

Low-floor, light-rail vehicles have been on the market for some time, but the benefits and risks associated with incorporation of the vehicles into a transit fleet have not been clearly understood. The authors of Report 2, *Applicability of Low-Floor Light Rail Vehicles in North America*, noted that the use of low-floor, light-rail vehicles is widespread in Europe and concluded that essentially no cost or safety risks are associated with the vehicles. Indeed, use of the vehicles in Santa Clara County, California, is estimated to have saved the county \$20 million in construction costs because high platforms were not required to provide access for persons with disabilities.

The report influenced New Jersey Transit's decision to select low-floor vehicles for the new Hudson-Bergen light-rail transit line. The agency's confidence in the vehicles was also increased by a staff member's account of their use in Europe. The staff member encouraged his agency to use the vehicles after observing them as a participant in TCRP's International Transit Studies Program.

Traffic-Control Devices

The *Manual on Uniform Traffic Control Devices* sets the standard in the United States for road signs and signals. In January 1997 the National Committee on Uniform Traffic Control Devices voted to adopt a new light-rail chapter for the manual. Research undertaken through the Transit Cooperative Research Program is the basis, in part, for this chapter. Report 17, *Integration of Light Rail Transit into City Streets*, supplies the draft language for the chapter and the rationale for including discussion of light-rail-transit safety issues in the manual for the first time.

Standardized Railcar Systems

Transit-rail operators could save as much as \$120 million as a result of the development of uniform technical standards for vehicle systems and subsystems. The standards, which should lower the cost of transit-railcars and replacement parts, reduce parts inventories, and simplify maintenance, are evolving through a consensus-building process. The project involves more than \$1.5 million in in-kind contributions by the transit industry, leveraging the TCRP investment by a ratio of 75 to 1.

Alternative-Fuel Safety

Fuels such as methanol, compressed natural gas, and liquefied natural gas have characteristics very different from diesel fuel or gasoline. Guidance on the handling of these potentially dangerous fuels is offered in Synthesis of Transit Practice 1, *Safe Operating Procedures for Alternative Fuel Buses*. New Jersey Transit and one bus manufacturer report that they have used this publication to plan for safe operation of alternative-fuel vehicles.

Risk Management

Risk-related losses for the transit industry exceed \$1 billion per year. To reduce these losses, risk-management software and a user's guide have been tailored to the needs of the transit industry. Two companion research results digests cover identification of risk exposure, assessment of risk, programs for controlling risk-related losses, and guidelines for consistent collection of loss data. Through TCRP Project J-1, "Dissemination and Implementation of Research Findings," the American Public Transit Association professionally packaged these products for distribution.

Visual Impact of Electric Vehicles

Light-rail and electric-trolley buses can provide clean and efficient transportation in congested corridors, but the public often reacts negatively to the



overhead power-supply wires for these vehicles. Citizen opposition to the wires can prevent the introduction or extension of electric-transit systems. The Greater Cleveland Rail Transit Authority used the findings of Report 7, *Visual Impact of Overhead Contact Systems for Electric Transit Vehicles*, to minimize the visual impact of power-supply lines for a light-rail extension.

Performance Measurement

Two TCRP publications are helping transportation agencies review transit-performance measures and the use of these measures in allocation formulas. The Wisconsin Department of Transportation found Synthesis of Transit Practice 6, *The Role of Performance-Based Measures in Allocating Funding for Transit Operations*, and Report 8, *The Quality Journey: A TQM Roadmap for Public Transportation*, to be of value in developing a long-range transportation plan. The publications have also been useful to metropolitan planning organizations in Wisconsin.

International Transit Studies

The International Transit Studies Program is a leadership development program intended to foster a multimodal-mobility-manager approach to urban transportation. Participants in the program bring innovative ideas from overseas to transportation agencies in the United States. New Jersey is using information on transit's contribution to livable communities in Europe to develop a transit-friendly, land-use initiative. As part of this initiative, New Jersey Transit is evaluating possible adoption of contactless "smart" cards for fare payment. Such cards are more widely used in Europe than in the United

Light rail enhances livability of Portland, Oregon. Integration of light-rail transit into city streets is subject of report produced by Transit Cooperative Research Program.

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