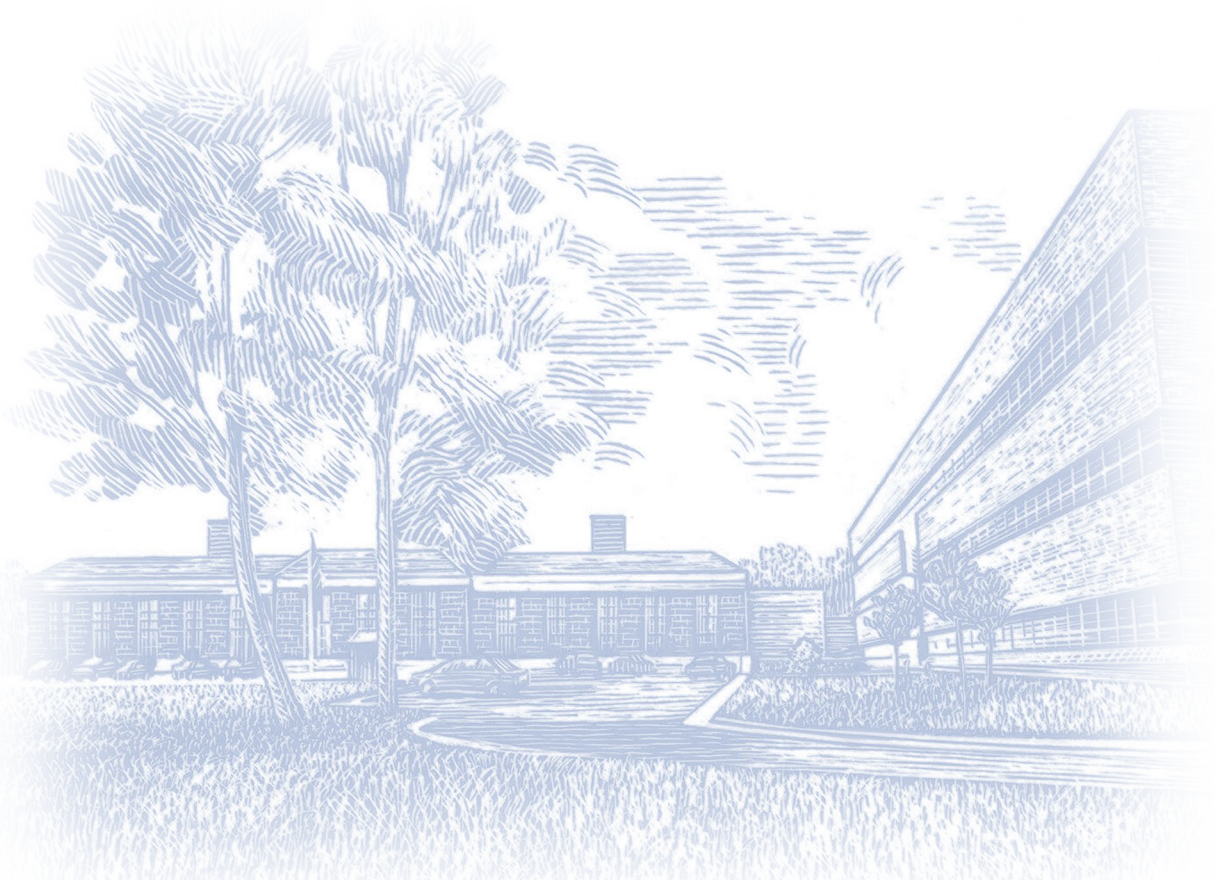


LTPP 2001 Year in Review

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Foreword

Almost 90 percent of all personal transportation takes place on highways (Federal Highway Administration, FY 2002 Performance Plan and FY 2000 Performance Report). Highways connect people with work, school, community, and markets. Continually improving the quality of the Nation's highway system is an essential component of the Federal Highway Administration's (FHWA's) mission. Indeed, continually improving the public's access to activities, goods, and services -- keeping the public mobile -- is one of FHWA's strategic goals.

To achieve its mobility goal, FHWA has implemented several initiatives. One of the longest running initiatives is the Long Term Pavement Performance (LTPP) program. LTPP's goal is to improve pavement performance and cost-effectiveness. To achieve its goal, LTPP collects data from more than 2,500 pavement sections in North America, analyzes these data to explain how and why pavements perform as they do, and then translates these insights into products and information for pavement design, rehabilitation, maintenance, and management.

In 2001, LTPP continued to play a key role in the development of the *2002 Guide for Design of New and Rehabilitated Pavement Structures* by the National Cooperative Highway Research Program (NCHRP). LTPP data are being used to validate and calibrate design procedures, and as a source of design inputs for the new guide. LTPP also continued its efforts to increase the quality and quantity of traffic data in 2001 through the Specific Pavement Studies (SPS) Traffic Data Collection Pooled-Fund Study. LTPP met with more than 25 State highway agencies. In addition, five pilot studies were completed and several traffic data collection protocols were finalized.

LTPP also completed several data analysis projects in 2001. Findings from one of these studies has yielded new LTPP database tables providing information on the cumulative traffic loading to which LTPP test sections have been exposed. The year 2001 also saw the first LTPP data analysis pooled-fund solicitation issued for the "Effect of Multiple Freeze-Thaw Versus Deep Frost Penetration on Pavement Performance" project. The Pennsylvania Department of Transportation (PennDOT) and the North Carolina Department of Transportation (NC DOT) are co-sponsors of this project.

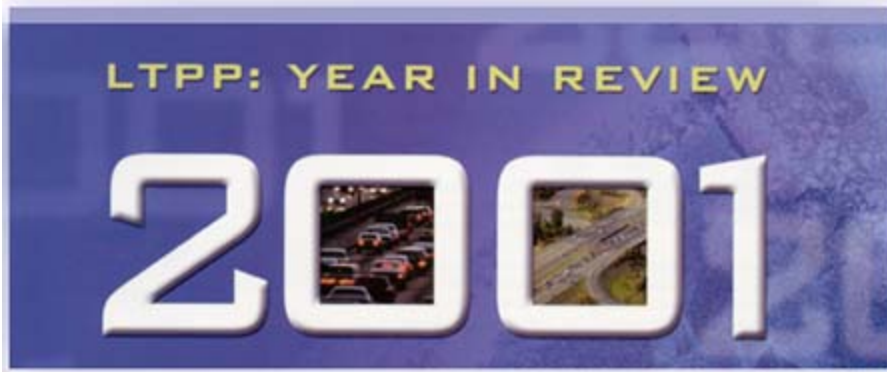
In 2001, LTPP introduced the latest version of DataPave -- DataPave 3.0 -- which provides desktop access to LTPP data. Throughout 2001, LTPP also continued to maintain and augment its current product offerings, such as LTPPBind, falling-weight deflectometer (FWD) technology, and resilient modulus testing.

As in previous years, LTPP's partners remained strong in their support of the program in 2001. The States and Provinces, the American Association of State Highway and Transportation Officials (AASHTO), NCHRP, the Canadian Strategic Highway Research Program (C-SHRP), the Transportation Research Board (TRB), and FHWA all continued to play key roles in helping the program achieve its goals.

Highways are the backbone of our Nation's transportation system. In 2001, LTPP continued its work toward improving the public's access to these highways by providing the information and data that highway engineers and managers need to design, build, maintain, and manage cost-effective and better performing roads. The purpose of this report is to outline the program's 2001 accomplishments in each of its program areas and to provide an overview of key initiatives that LTPP will be pursuing in 2002.

Table of Contents

Foreword.....	3
Accomplishments 2001.....	5
Data.....	5
Analysis.....	6
FHWA LTPP Data Analysis Projects.....	6
Products.....	7
Getting the Word Out.....	8
Meetings.....	8
Workshops/Contests.....	8
Publications.....	9
Research Reports.....	9
Website.....	9
Funding.....	10
The Partnership.....	10
THE STATES AND PROVINCES.....	10
TRANSPORTATION RESEARCH BOARD.....	11
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS.....	11
FEDERAL HIGHWAY ADMINISTRATION.....	11
The Future.....	12
Data.....	12
Analysis.....	12
Products.....	12
Communication & Coordination.....	13



Accomplishments 2001

Data

In 2001, LTPP data continued to play a critical role in the development of the *2002 Guide for Design of New and Rehabilitated Pavement Structures* by NCHRP. LTPP data are being used to calibrate and validate models incorporated into the 2002 procedures. In addition, LTPP data are used by pavement designers to supplement project-specific data or when such data are not available. Many LTPP procedures for testing materials, computing design inputs, and evaluation of existing pavement conditions will also be part of the 2002 Design Guide.

LTPP also continued its work to improve the quality and quantity of traffic data via the SPS Traffic Data Collection Study in 2001. Organized as a State pooled-fund study, its goal is to increase the quality and quantity of monitored traffic data -- volumes, classifications, and weights -- from the program's SPS-1, -2, -5, -6, and -8 projects. A core objective of these studies is to quantify the relationships between pavement performance and truck volumes and axle loadings. It is essential to quantify these relationships if progress is to be made in improving the ability to predict the long-term performance of Interstate and other major highways.

Throughout 2001, LTPP met with more than 25 State highway agencies to explain the specifics of implementing the SPS Traffic Data Collection Study, to assess each State's SPS sites, and to review LTPP's policy on the quality of traffic data. LTPP also completed five pilot site evaluations for the study in 2001. The site evaluations, which took place in Arizona, Florida, Maryland, Michigan, and Texas, were used to validate protocols, finalize the Data Collection Guide, and train personnel in annual weigh-in-motion (WIM) site evaluation activities. In addition, the Florida site evaluation did a comparative study between piezo and bending-plate WIM technology.

In 2001, LTPP awarded new 5-year regional contracts for the collection and processing of pavement performance data. In addition, a new study of the performance of pavement edge drains at SPS-1 and -2 sites and at some SPS-6 sites was launched. The objective of the study is to determine the condition of the drains and whether or not

they are working so that LTPP analysis conclusions as to the efficacy of drainage systems will be founded on complete information. In 2001, LTPP also initiated a project to develop forensic study guidelines. The guidelines are intended for use by LTPP regional contractors in conducting forensic studies to better understand why test sections fail.

Analysis

In 2001, FHWA completed four data analysis projects. Two additional projects are ongoing and two new projects were initiated.

The first LTPP data analysis pooled-fund solicitation was issued in 2001. The project, "Effect of Multiple Freeze-Thaw Versus Deep Frost Penetration on Pavement Performance," is co-sponsored by PennDOT and NC DOT, and will be managed by FHWA. To date, Alaska, Idaho, Illinois, Michigan, New York, North Carolina, and Pennsylvania have signed on as participants. The project's Technical Advisory Panel will convene in January 2002 to finalize project details.

Work toward a programmatic approach to LTPP data analysis continued in 2001. The TRB Expert Task Group (ETG) on LTPP Data Analysis reviewed and updated the LTPP Data Analysis Strategic Plan and the LTPP Data Analysis Program. The ETG continued to review and provide recommendations on FHWA-sponsored LTPP data analysis work and referred one project, "Pavement Damage Caused by Swelling and Frost-Susceptible Soils," to the TRB-LTPP Committee for possible consideration as a pooled-fund project.

The ETG also referred the following three LTPP data analysis projects to the TRB-LTPP Committee for possible consideration via the 2003 NCHRP program:

- Relationships Between Laboratory-Measured and Field-Derived Properties of Pavement Layers.
- Verification of Reflective Cracking Models.
- Integration of Traffic Inputs for Specific Pavement Applications.

In addition, the ETG referred several projects to the LTPP Product Subcommittee for possible consideration as product development or delivery projects. These included:

- Guidelines for Determining As-Built Material Properties.
- Guidelines for Integrating Measurement Variability in Network Pavement Management System (PMS) Condition Data Collection and Analysis.
- Pavement Traffic Loading Needs Workshop to Improve Pavement Design.

FHWA LTPP Data Analysis Projects

Completed in 2001:

- Estimation of Traffic Axle Load Spectra
- Review of Laboratory Materials Data



- Review of Laboratory Resilient Modulus Data for Unbound Materials
- Verification of LTPP Virtual Weather Stations

Ongoing in 2001:

- Review of LTPP Layer Thickness Data
- Seasonal Variations in Unbound Pavement Materials

Initiated in 2001:

- Review of SPS-8 Experiment
- Review of LTPP Joint and Crack Load Transfer Data

Products

LTPP remained focused on products in 2001. The TRB-LTPP Product Subcommittee continued to participate in planning for LTPP product development and delivery. The product plan, which the subcommittee had finalized in 2000, was published and distributed in 2001. In addition, the subcommittee forwarded five LTPP product development statements to the TRB-LTPP Committee for consideration. These were:

- Product development projects proposed for possible NCHRP 2003 funding:
 - Guidelines for Determining As-Built Material Properties Characteristics for Highway Agency Applications.
 - Guidelines for Integrating Measurement Variability in Network PMS Condition Data Collection and Analysis.
- Product development projects proposed for possible pooled funding:
 - Pavement Profiler Procurement, Calibration, and Maintenance and Operations Guidelines.
 - FWD Calibration Center and Operational Improvements.
 - Evaluation and Implementation of Resilient Modulus for Unbound Materials Test Procedures.

In 2001, LTPP also released a new version of DataPave -- DataPave 3.0. This new version provides up-to-date data and includes improvements to the data selection filters and enhancements to enable extraction of site-specific climatic data records.

In addition, work to provide an updated start-up procedure for servo-hydraulic laboratory dynamic test systems was completed. This product is an extension of the previously developed LTPP laboratory resilient modulus start-up procedure. Application of this procedure prior to the start of laboratory testing ensures that the testing equipment is functioning properly so that accurate and meaningful data are collected. A proposed standard based on the procedure will be forwarded to the AASHTO Subcommittee on Materials for their consideration.

FHWA's Office of Pavement Technology also continued its work with several LTPP products in 2001. These included profile viewer software; National Highway Institute course 131062, PCC [Portland Cement Concrete] Evaluation and Rehabilitation, and course 131063, HMA [Hot-Mix Asphalt] Evaluation and Rehabilitation; and four NCHRP-funded projects. The NCHRP-funded projects are: the PCC Pavement Practice Manual, Guidelines for Temperature Adjustment of Falling-Weight Deflectometer Results on CD-ROM, Guidelines for Design Resilient Modulus for Soils on CD-ROM, and a Seasonal Monitoring Program CD-ROM.

Lastly, FHWA's Midwestern Resource Center, in cooperation with Caltrans [California Department of Transportation], continued work on "Anytime Weather," a climatic database. Currently, Caltrans is pursuing enhancements to the program. Once that work is completed, FHWA will pursue additional enhancements.

Getting the Word Out

LTPP announces research results through meetings; publications; its website; and working in cooperation with State highway agencies, industry trade associations, and professional societies. In 2001, LTPP continued to spread the word about the program and its results through as many venues as possible.

Meetings

Each year, LTPP staff and contractors make presentations at various industry trade association and government meetings throughout the United States. In 2001, these activities included the LTPP Box Session, State Coordinators Meeting, LTPP International Coordinators Meeting, and several other LTPP presentations at the 2001 TRB annual meeting.

In May 2001, LTPP made a presentation on the traffic pooled-fund study at the FHWA Pavement Engineers meeting in San Francisco, California. Also in May, LTPP presented "What's Going on in LTPP" at the Southeastern Pavement Conference in Asheville, North Carolina. During the summer of 2001, LTPP made two presentations at the Weigh-in-Motion Conference held in Denver, Colorado, on July 24 and 25 -- "Expectations for Traffic Data" and "SPS Traffic Data Collection Plan." In July, LTPP presented "What's Going on in LTPP" to the AASHTO Subcommittee on Materials in Kalispell, Montana. Finally, in October, LTPP presented their products at the FHWA Pavement Engineers meeting in Baltimore, Maryland.

Throughout the year, LTPP also met with more than 25 State highway agencies about the SPS Traffic Data Collection Pooled-Fund Study.

Workshops/Contests

To help DataPave users learn how to take advantage of the DataPave software, FHWA's Office of Pavement Technology and the American Society of Civil Engineers (ASCE) co-sponsored a workshop. Targeted toward academicians, the "Professor Training Workshop on LTPP Data Analysis" was held in Reno, Nevada, on December 14 and 15, 2001. The FHWA and ASCE also kicked off the third International Contest on LTPP Data Analysis. This year's contest, which is also supported by the American Concrete Pavement Association (ACPA) and the Asphalt Institute, includes categories for undergraduate students, graduate students and professors.

Publications

What are the benefits of the LTPP program to date? To address this question, LTPP published an eight-page document, *An Investment Benefiting America's Highways: The Long Term Pavement Performance Program*, which discusses the current and future benefits of the program. In addition, to address the need for a formalized product development and delivery process, LTPP published the *LTPP Product Plan*. This nine-page document identifies key participant roles and responsibilities, establishes a formal product identification and tracking system, and specifies a reporting mechanism for product effectiveness.

LTPP also continued to keep the highway community up-to-date on its research findings, products, and how some States are using its products through its TechBriefs, Product Briefs, and Application Notes. TechBriefs bring concise summaries of recent LTPP data analysis projects to users. Product Briefs provide an overview of the product, along with technical background, key features, and product benefits. Application Notes detail how some States are using LTPP products or analysis findings and the benefits they are accruing from them.

Research Reports

FHWA published several research reports documenting FHWA-sponsored analysis of LTPP data in 2001. The published reports contain research findings that are considered to be of broad interest. Copies of the reports are distributed to State and Provincial highway agencies, FHWA Headquarters, Resource Centers and Division offices, members of TRB committees advising LTPP, and other interested parties. Reports documenting significant findings of interest to a limited audience are distributed on a limited basis. LTPP research reports considered to be of limited interest are submitted to the National Technical Information Service in order to provide a readily accessible public record of work that was done, but not formally published.

Website

LTPP's website is designed to provide information on the program's ongoing research activities and the products and reports that result from these activities. In 2001, LTPP continued to publish the results of its analytical findings in the Library section. Information on the latest LTPP research reports, Product Briefs, Application Notes, and resource documents can be quickly accessed via this section. Similarly, updates to LTPP's Data Analysis Strategic Plan or Data Analysis Program can easily be accessed via the Analysis section and updates to all LTPP products can be found via the Products section.

In 2001, LTPP also continued to use its website as a key information source on the Traffic Data Collection Pooled-Fund Study. Continually updated, this section contains the latest information on the study, along with background information and frequently asked questions.

Funding

Approximately \$8.77 million of LTPP's funding in 2001 was authorized by Transportation Equity Act for the 21st Century (TEA-21) legislation. As you will recall, with the passage of TEA-21 in May 1998, LTPP's total budget was effectively reduced by about one-third. Recognizing that a budget cut of this size put LTPP's ability to deliver much-needed and long-awaited results in jeopardy, AASHTO's Board of Directors approved approximately \$3.55 million in NCHRP funding for LTPP in fiscal year (FY) 2001.

Approximately \$7.5 million of the TEA-21 funds and \$3.1 million of the NCHRP funds were used for LTPP data collection field operations in 2001. Without the additional NCHRP funding, LTPP would not have been able to collect all of the data needed or to purchase badly needed replacements for the monitoring equipment.

LTPP's analysis program was allocated approximately \$650,000 from TEA-21 funds in 2001, along with \$150,000 from NCHRP funds. In terms of product development, \$200,000 came from TEA-21 funds and \$100,000 from NCHRP funds. Similarly, for communications and coordination activities, \$370,000 was allocated from TEA-21 funds, with \$200,000 coming from NCHRP. The NCHRP funds for analysis and product development are managed by NCHRP. NCHRP funds provided for communications activities and coordination are used to support the activities of the TRB-LTPP Committee and its supporting ETGs.

At the spring AASHTO meeting, the FY 2002 NCHRP budget for LTPP was approved. Approximately \$3.65 million of NCHRP funding will be provided, of which \$3.1 million is allocated for data collection field operations, \$350,000 is allocated for data analysis projects, and \$200,000 is allocated for communications and coordination activities.

The Partnership

LTPP is a partnership. The State and Provincial highway agencies, TRB, AASHTO, C-SHRP, and FHWA are all deeply involved in the program and are essential to its success.

THE STATES AND PROVINCES

As owners of the LTPP test sections, the State and Provincial highway agencies have made significant investments in the program. They have designated the test sites, constructed the test sections, supplied test materials, and collected data from the test sites. They provide traffic data and support monitoring of test section performance on an ongoing basis. The State and Provincial highway agencies are also the primary users of the results garnered from the program and, as such, are LTPP's primary customers.

The States also play a key role in pooled-fund studies initiated by LTPP. Of particular interest is the support of several States for LTPP's current SPS Traffic Data Collection Pooled-Fund Study. Similarly, several States have lent their support to LTPP's data analysis pooled-fund project, "Effect of Multiple Freeze-Thaw Versus Deep Frost Penetration on Pavement Performance."

TRANSPORTATION RESEARCH BOARD

TRB operates several committees that provide input and advice on LTPP's research and implementation activities. The members of these committees come from the State and Provincial highway agencies, industry, academia, and the international highway community. The TRB-LTPP Committee provides management-level input on the conduct of LTPP. In addition, there is a product subcommittee and several topic-specific ETGs that provide technical review and input for key program areas. The dedicated volunteers who serve on these committees are a tremendous asset to LTPP.

In 2001, the TRB-LTPP Committee completed its work on issues associated with completing the LTPP mission. Work on these issues resulted in a draft document, *Fulfilling the Promise of Better Roads*. The draft document will be available early next year.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO has played a critical role in LTPP from the program's inception. From test section recruitment to the adoption of LTPP-developed methods, procedures, and guidelines as standards for pavement engineering, AASHTO has provided the collective leadership for many of the program's successes to date. The AASHTO Task Force on SHRP Implementation is the primary conduit for LTPP-related matters. Indeed, it was this task force that put forth the issues associated with SPS traffic data collection and worked with the TRB-LTPP Committee in the development of the pooled-fund study proposal to address the problem.

In 2001, AASHTO sunset the task force, replacing it with the Technology Implementation Group (TIG). LTPP will continue to work with AASHTO through the TIG, the Subcommittee on Materials, the Joint Task Force on Pavements, and other committees as needed.

FEDERAL HIGHWAY ADMINISTRATION

FHWA's Office of Infrastructure Research and Development manages LTPP's day-to-day research operations. Specific activities include the collection, processing, and dissemination of data; national analysis activities; and LTPP communications and coordination. In addition, FHWA's Resource Centers, Divisions, and Office of Pavement Technology play key roles in the LTPP program. FHWA's Office of Pavement Technology leads LTPP product development activities, along with activities related to packaging the products for delivery. FHWA Resource Centers lead LTPP product delivery to the States, Divisions, and highway industry, and also participate in the management of LTPP data collection activities. The Divisions work directly with the States that support LTPP's data collection effort, in addition to assisting with product delivery, technical support, and overall communications and coordination.

The Future

In 2002, LTPP will continue to support FHWA's strategic goal to continually improve the public's access to activities, goods, and services. It will do so by providing answers to how and why pavements perform as they do. These answers will be factual and accurate; will apply across the length and breadth of the Nation; and will help highway managers and engineers to design, build, and maintain roadways that will be long-lived and cost-effective. Highlights of efforts in each of LTPP's programmatic areas for 2002 include:

Data

In 2002, LTPP will continue to focus on implementing the pooled-fund study to improve the quality and quantity of traffic data collection at the program's SPS-1, -2, -5, -6, and -8 projects. Specific tasks in 2002 include collecting traffic data, implementing the protocols completed in 2001, and finalizing the *Field Data Collection Manual*.

LTPP is also on target to finalize its study of pavement edge drains at SPS-1, -2, and -6 sites and will issue a final report in Spring 2002. LTPP will also have forensic guidelines in place in 2002 for those States that wish to participate in forensic studies of failed test sections. In addition, LTPP plans to kick-off a new study in 2002. The study will focus on using ground-penetrating radar to determine the layer thicknesses of all SPS-1 test sections, plus one each for the SPS-2, -5, and -6 sites.

Analysis

In 2002, a programmatic approach to achieving the objectives defined in the 1999 Strategic Plan for LTPP data analysis will be continued. The LTPP staff will continue to work with the TRB-LTPP Committee, the TRB Expert Task Group on LTPP Data Analysis, AASHTO, NCHRP, and others to achieve a coordinated national program of analysis that will attain the outcomes defined in the plan. FHWA's analytical resources will be devoted to continuing the ongoing systematic review and evaluation of LTPP data that are needed to support subsequent analysis.

Products

In addition to completing most of the ongoing product development projects, in 2002, LTPP will pursue pooled funds for several product projects, including Pavement Profiler Procurement, Calibration, and Maintenance and Operations Guidelines; FWD Calibration Center and Operational Improvements; and Evaluation and Implementation of Resilient Modulus for Unbound Materials Test Procedures. A proposed standard laboratory start-up procedure for servo-hydraulic laboratory dynamic test systems will be forwarded to the AASHTO Subcommittee on Materials for their consideration. Lastly, another update of the DataPave software is planned.

Communication & Coordination

In 2002, FHWA will continue to explore new venues for keeping LTPP partners and customers up-to-date on its work and research results.