# LTPP 1999 Year in Review

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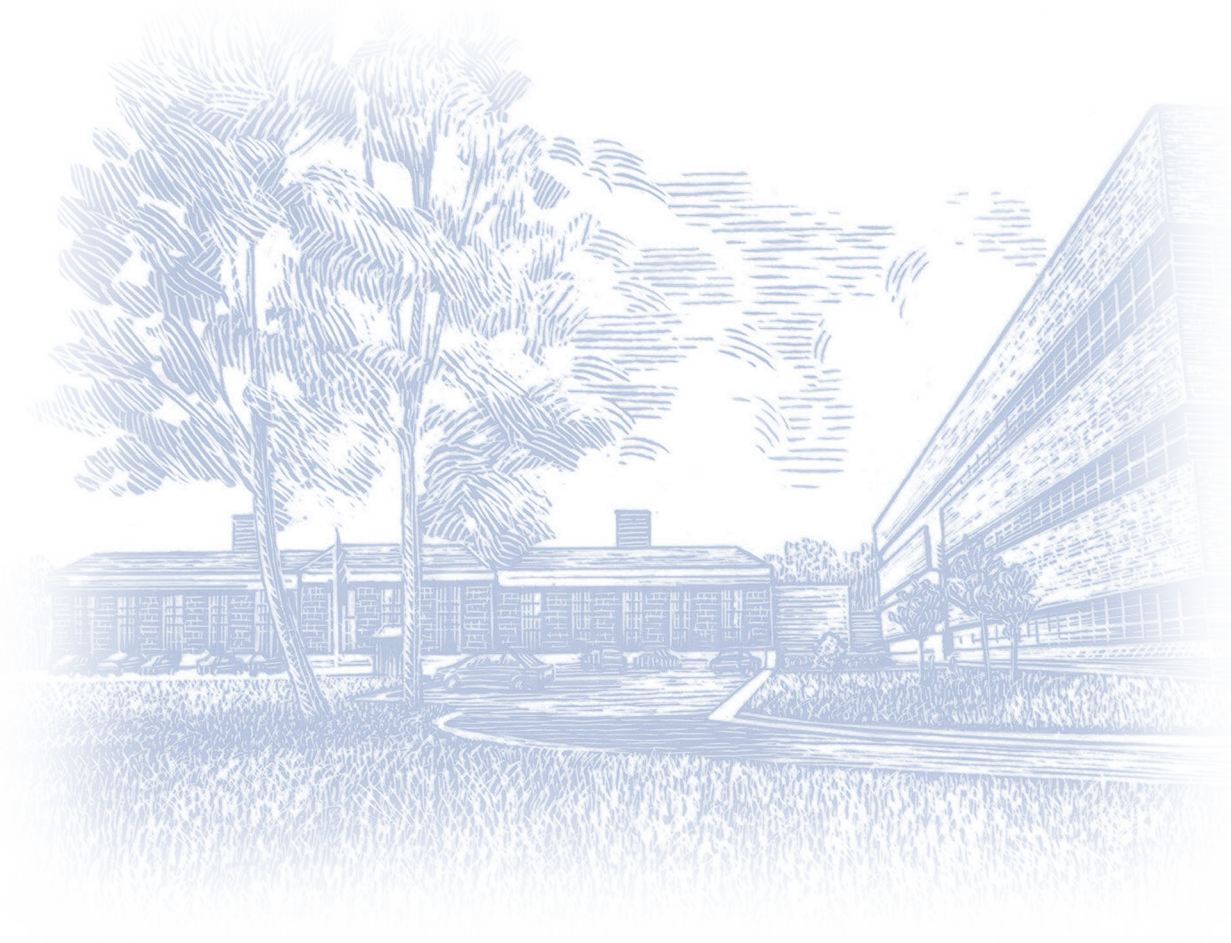

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# Table of Contents


## Introduction

Improving the productivity and mobility of the national highway transportation system is a key goal of the Federal Highway Administration (FHWA). During 1999, FHWA's Long-Term Pavement Performance (LTPP) program continued to work toward these goals through its efforts to provide answers to how and why pavements perform as they do.

Pavements are where the proverbial rubber meets the road. They are at the core of the Nation's highway transportation system's infrastructure. To better understand pavement performance, LTPP gathers and processes data describing the structure, service conditions, and performance of more than 2,400 pavement test sections in all 50 States, the District of Columbia, Puerto Rico, and the 10 Canadian Provinces. In 1999, this information helped the program to update two of its key products – DataPave and LTPPBind. With the new versions of these software packages, highway engineers will now have more data to help them make decisions that lead to more cost-effective and better performing pavements. LTPP also launched the final stage of its Data Resolution effort by implementing data monitoring adjustments. With these adjustments, the States, Provinces, and FHWA can allocate financial and human resources more effectively.

LTPP also completed several data analysis projects in 1999. Findings from one of these projects will help highway engineers and managers effectively consider the effect of temperature when they evaluate pavement deflection data collected at different times of the year. Other projects yielded computed parameters (i.e., engineering parameters or summary statistics derived from the raw LTPP data) that will facilitate future analysis of the LTPP data. Eleven reports documenting LTPP's 1999 analysis findings were published by FHWA, in addition to four LTPP TechBriefs (summaries of LTPP's recent research findings and how they will affect current practices).

As in previous years, LTPP's partners remained strong in their support of the program. The States and Provinces, the American Association of State Highway and Transportation Officials (AASHTO), 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 to achieve its goals. Indeed, in 1999, AASHTO continued its financial support of the program, providing supplemental funding of $5.025 million. Without this additional funding, the ability to effectively conduct LTPP research would be seriously jeopardized.

LTPP's role in AASHTO's 2002 Design Guide was also solidified in 1999. In addition to the use of LTPP data for validation and calibration of the design procedure, LTPP data will be used as input for models/equations to characterize materials and will determine the effects of various environmental conditions.

Throughout 1999, LTPP continued its quest to provide the information and data that highway engineers and managers need to design, build, and maintain cost-effective and long-lived roads. The purpose of this report is to outline the program's 1999 accomplishments in each of its program areas and to provide an overview of key initiatives that LTPP will be pursuing in 2000.

## 1999 Accomplishments

### Data

In 1999, LTPP continued to make significant progress toward its Data Resolution goals. Based on the data resolution meetings held with the States, FHWA Regional Offices, and Provinces in the summer and fall of 1998, LTPP developed a summary report that identified questionable or missing data, along with how these data issues were going to be resolved, i.e., monitoring adjustments. The summary reports were completed in Spring 1999 and were distributed in July to each State and Provincial highway agency with a letter describing the impact of the proposed monitoring adjustments. The States and Provinces were requested to return a Letter of Commitment in which they agreed to support monitoring adjustments outlined in the report for their State or Province. As of September 1999, approximately 60 percent of the States and Provinces had committed to supporting the monitoring adjustments. LTPP continued to work with the other States and Provinces and implementation of the new monitoring schedules began in November 1999.

One unexpected result of LTPP's Data Resolution effort that became clear in 1999 was that 50 percent of LTPP's Special Pavement Studies (SPS) projects were not going to have sufficient traffic data. Based on this information, the TRB-LTPP Traffic Expert Task Group (ETG) reviewed the situation and presented a proposed course of action to the TRB-LTPP Committee at the June 1999 meeting. The proposed course of action called for an in-depth technical and financial assessment of what it would take to get good traffic information. This meant reviewing equipment, calibration, and data processing requirements. The results of the in-depth study were presented at the November 1999 TRB-LTPP meeting.

LTPP's role in the AASHTO 2002 Design Guide was also solidified in 1999. Not only will LTPP data be used for the validation and calibration of the performance models, it will also be used as input to predict moisture temperature states and as regional/local typical inputs in predictive equations/routine tests for material characterization. LTPP backcalculation procedures will also be used for deflection tests to evaluate existing pavement condition and material characterization.

### Analysis

For the LTPP data analysis effort, 1999 was a year of transition. The year was marked by the completion of analysis funded under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the initiation of the first National Cooperative Highway Research Program (NCHRP)-LTPP analysis project. Nine FWHA-sponsored analysis projects were completed. Six additional FHWA projects were ongoing, and three new projects were initiated. NCHRP project panels were convened to consider LTPP data analysis problem statements, and several NCHRP-LTPP analysis requests for proposal were issued. Highlights of the analysis projects completed in 1999 included:

- *Temperature Prediction and Correction* yielded simplified procedures for estimating the temperature of asphalt concrete pavements from readily available information, and improved relationships for adjusting deflection test results for temperature. These tools will help highway agency engineers interpret and use pavement deflection data collected under different temperature conditions.
- *Analysis of Pavement Distress Data Variability* provided quantitative information on the level of variability in pavement distress ratings obtained through both manual distress surveys and photographic methods. These findings provide a basis for guidelines for collecting distress data to achieve a desired level of certainty and for interpreting the significance of year-to-year changes in pavement condition.
- *Computed Parameters* – Three projects, Analysis of Time-Domain Reflectometry Measurements, Analysis of Electrical Resistance Data, and Backcalculation of Material Properties From

Deflection Data, resulted in the addition of computed parameter tables to the LTPP database. In situ moisture content and frost penetration data are now available for the LTPP Seasonal Monitoring sites. Backcalculation results are available for all of the LTPP test sections. The addition of these tables to the database will greatly reduce the effort required in future data analysis. Engineers will be able to focus on the problem to be addressed, rather than the processing of the required data.

In 1999, the TRB Expert Task Group on LTPP Data Analysis also identified a need for an updated strategic plan to guide project identification and selection activities. This need was met through the development of the updated LTPP data analysis strategic plan that is available at LTPP's website (http://www.tfhrc.gov).

| 1999 ANALYSIS PROJECTS |
| --- |
| Completed<br>• Evaluation of the Effects of Rehabilitation on Pavement Performance<br>• Analysis of LTPP Friction Data<br>• Analysis of Time-Domain Reflectometry Measurements<br>• Analysis of Pavement Distress Data Variability<br>• Analysis of Electrical Resistance Data<br>• Backcalculation of Material Properties From Deflection Data<br>• Mechanistic Evaluation of Test Data From the LTPP Program<br>• Temperature Prediction and Correction<br>• Analysis of LTPP Joint Faulting Data |
| Ongoing<br>• Traffic Backcasting<br>• Study of Longitudinal Profile Variability<br>• Seasonal Variation in Unbound Pavement Materials<br>• Study of LTPP Deflection Data<br>• Study of LTPP Pavement Temperatures<br>• Production of a Computational Data Set for Distress Analysis |
| Initiated<br>• Review of the Structural Factors (SPS-1 and -2) and Rehabilitation (SPS-5 and -6) Experiments<br>• Review of the LTPP Pavement Maintenance and Rehabilitation Data<br>• Review of Laboratory Materials Data |

## Products

In 1999, LTPP began a transition. For years (from its inception in 1987), LTPP was focused on designing and implementing a research program. First, the experiments had to be designed and built. Then, data from the experiments had to be collected and housed in a national database. A program for analyzing the data then needed to be formulated and implemented. As the program has progressed, emphasis on one area or another has changed. Once the experiment was designed, more energy was focused on collecting the data; once data collection was under control, the focus shifted to developing a national database to house the data. In 1999, LTPP shifted its focus to products.

LTPP recognized that to successfully derive products from a research program, it needed a process for identification of potential products, a means for successfully carrying the potential products into development, and a formal delivery process to get the products out to the field where they were needed. To this end, the TRB-LTPP Product Subcommittee was formed. In 1999, the subcommittee met three times. During the first meeting, the group developed a mission statement; at the second meeting, they identified specific product projects for 2001; and at the third meeting, initial steps for a product development process were identified.

In 1999, LTPP also released new versions of two LTPP products:

- *DataPave 2.0* holds nearly three times as much data as the earlier version and includes new LTPP database tables. Other new features include enhanced program functions, such as customized printout and export capabilities for individual section reports, in addition to tutorials that walk users through the program and provide data set examples.
- *LTPPBind 2.1* features several updates. These include an increase in the number of weather stations available in the program and other enhanced program functions, such as printing capability for all reports and the ability to run the software directly from a CD-ROM version.

LTPP also updated three manuals compiled under the Strategic Highway Research Program (SHRP): the 1993 SHRP Spall Repair Manual; the 1993 SHRP Joint Seal Repair Manual; and the 1993 SHRP Crack Sealing and Filling Manual.

The updated manuals reflect the inclusion of the results from the FHWA-sponsored study Long-Term Monitoring of Pavement Maintenance Materials Test Sites, the purpose of which was to continue monitoring the performance of experimental repairs and treatments on pavement test sections of the original SHRP studies between 1993 and 1997. The new manuals contain the latest information pertaining to the performance of repair materials and methods; the availability and relative costs of repair materials; and the proper way of planning, designing, constructing, and monitoring repair projects.

# Getting The Word Out

LTPP announces research results through publications; its website; meetings; and working wherever possible in cooperation with State highway agencies, industry trade associations, and professional societies. In 1999, LTPP continued to spread the word through as many venues as possible about the program and its results to date.

## Meetings

Each year, FHWA-LTPP staff and contractors make presentations at various industry, trade association, and government meetings throughout the United States. In 1999, these activities included the LTPP Box Session, State Coordinators Meeting, LTPP International Coordinators Meeting, and several other LTPP

presentations at the 1999 Annual TRB Meeting. In addition, LTPP exhibited and made presentations at AASHTO's Annual Meeting in October. Shortly thereafter, in November 1999, LTPP provided a national overview of their program at the Ohio Department of Transportation's Early Lessons From the SHRP SPS-1 and SPS-2 Pavements Conference.

LTPP also held a series of LTPP Regional Meetings throughout 1999 to brief the States and Provinces on LTPP products, the results of the data resolution effort, and LTPP's data analysis efforts.

## Workshops/Contests

LTPP continued to help DataPave users learn how to take advantage of the DataPave software via FHWA and the American Society of Civil Engineers (ASCE) co-sponsored workshops. In 1999, DataPave workshops were held in Canada and Egypt. ASCE and FHWA also closed-out the first year of the Data Analysis Contest in 1999.

## Publications

Findings from LTPP analyses projects provide key information that helps highway engineers and managers in their day-to-day operations. To keep the highway community apprised of LTPP's analysis efforts, FHWA published a 12-page document entitled LTPP Analysis: Putting the Data to Work. The document outlines the analysis projects that will be undertaken by FHWA in fiscal years (FYs) 1999 and 2000 and those planned for pursuit through 2003. In addition, since analysis of LTPP data is now a shared responsibility with NCHRP, the report also outlines the project selection process and projects recommended for the FYs 1999 and 2000 NCHRP-LTPP analysis projects.

In 1999, LTPP also launched its Product Brief series. LTPP Product Briefs provide an overview of the product, including technical background information, key features, and product benefits. LTPP also continued to keep the highway community up-to-date on the program's research progress and findings through TechBriefs. LTPP TechBriefs bring concise summaries of recent LTPP data analysis projects to users. Both LTPP Product Briefs and TechBriefs are mailed to State and Provincial highway agencies, FHWA headquarters and field offices, members of TRB committees advising LTPP, and other interested parties. They are also available at LTPP's website (http://www.tfhrc.gov).

## Research Reports

FHWA published 11 research reports documenting FHWA-sponsored analyses of LTPP data in 1999. 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 and field offices, members of TRB committees advising LTPP, and other interested parties. An annotated bibliography of these reports and reports from previous years is available on LTPP's website (http://www.tfhrc.gov).

| LTPP 1999 Publications |
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| Brochure<br><br>• LTPP Analysis: Putting the Data to Work (FHWA-RD-99-169) |
| TechBriefs<br><br>• Resealing Concrete Pavement Joints (FHWA-RD-99-137)<br>• Portland Cement Concrete (PCC) Partial-Depth Spall Repair (FHWA-RD-99-177)<br>• Pothole Repair (FHWA-RD-99-176)<br>• Sealing and Filling Cracks in Asphalt Pavements (FHWA-RD-99-151) |
| Product Briefs<br><br>• DataPave: User-Friendly Access to LTPP Data (FHWA-RD-99-051)<br>• LTPPBind: A New Tool for Selecting Cost-Effective Superpave Asphalt Binder Performance Grades (FHWA-RD-99-082)<br>• Rigid Pavement Design Software: A New Tool for Improved Rigid Pavement Design (FHWA-RD-99-129)<br>• Videotapes Explain the How and Why of LTPP's Revised Resilient Modulus Laboratory Tests and Procedures (FHWA-RD-99-162)<br>• Working With Your FWD Calibration Center Videotape (FHWA-RD-99-163)<br><br>*In 1999 LTPP also published 11 research reports* |

## 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 1999, LTPP continued to publish results of its analysis findings in the Library section of the LTPP website. This section provides information on LTPP's resource documents and all LTPP brochures and Product Briefs, in addition to a complete bibliography of research reports from FHWA-LTPP-sponsored data analysis and all corresponding LTPP TechBriefs. From LTPP's website, users request or download LTPP's software products (LTPPBind and Rigid Pavement Design software), get the latest results from analysis projects, or check out the LTPP calendar to see where and when upcoming events/meetings will be held.

## Funding

Approximately $8.83 million of LTPP's funding in 1999 were provided for under the Transportation Equity Act for the 21st Century (TEA-21). As you may recall, with the passage of TEA-21 in May 1998, LTPP's total budget was effectively reduced by about one-third. Quick to recognize 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 $4.7 million in supplemental funding for LTPP in FY 1999.

Approximately $7.39 million of the TEA-21 funds, along with $3.1 million of the AASHTO funds, were used for LTPP data collection field operations in 1999. Without the additional AASHTO funding, LTPP would not have been able to collect all of the necessary data or purchase badly needed replacements for monitoring equipment.

LTPP's analysis program was allocated $762,000 from TEA-21 funds in 1999, along with $1.195 million of the AASHTO supplemental funding. The AASHTO funds were managed through NCHRP. FHWA-LTPP-funded analysis projects in 1999 included: Review of the LTPP Pavement Maintenance & Rehabilitation Data, Review of Structural Factors (SPS-1 and -2) and Rehabilitation Experiments (SPS-5 and -6), and Review of Laboratory Materials Data. NCHRP-LTPP 1999 analysis projects that were recommended for funding included: Efficacy of Sealing Jointed Plain Concrete Pavement Joints, Determination of Service Life for Rehabilitation Options, Timing and Effectiveness of Maintenance Treatments for Flexible Pavements, Variability of Design Inputs for Mechanistic Design, Verification of Pavement Design Values Using Construction Test Data for SPS-1 and SPS-2 Sites, Procedures for Estimating Seasonal Variation in Load-Carrying Capacity, and Factors Affecting Roughness.

In terms of product development, $138,000 came from TEA-21 funds, which were supplemented with $200,000 of AASHTO funding. Similarly, for communication and coordination activities, $540,000 was provided for from TEA-21 funds, with $205,000 coming from AASHTO supplemental funds.

At the spring AASHTO meeting, the FY 2000 budget for LTPP was approved. A total of $5.025 million was budgeted, of which $3.1 million was allocated for data collection field operations, $950,000 was allocated for data analysis projects, $775,000 was allocated for product development, and $200,000 was allocated for coordination and communication activities.

## The Partnership

LTPP was designed as a partnership. The State and Provincial highway agencies, AASHTO, TRB, C-SHRP, and FHWA are all deeply involved in the program.

### 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, and academia. The TRB-LTPP Committee provides management-level input on the conduct of LTPP. In addition, there are several topic-specific ETGs that provide technical review and input for key program areas.

In 1999, a few changes were made to the TRB-LTPP committee structure. Specifically, the TRB-LTPP Program Improvement Subcommittee was dissolved. Initiated in 1997 to provide advice and counsel as LTPP entered its second decade, the subcommittee played a major role in developing the strategy for LTPP's Data Resolution effort and in formalizing its product development and delivery processes. As LTPP has begun to focus more of its efforts on product development and delivery efforts, a TRB-LTPP

Product Subcommittee was formed in 1999 to help the program effectively address the technical and political issues of how to identify potential LTPP products and get them out into the field.

### 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 and monitored the test sections, supplied test materials, and collected traffic and other data from the test sites. 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.

### Federal Highway Administration

FHWA's Office of Infrastructure Research and Development manages the day-to-day operations of LTPP. Specific activities include the collection, processing, and dissemination of data; national analysis activities; and product development and delivery activities. In addition, FHWA's Resource Centers and the Office of Infrastructure's Central Business Unit support LTPP. FHWA Resource Centers participate in the conduct of the LTPP program and provide support for LTPP product delivery to the States, Divisions, and highway industry. FHWA's Office of Infrastructure's Central Business Unit leads LTPP product development activities.

### 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 the AASHTO-SHRP Implementation Task Force that put forth resolutions that ultimately lead to the AASHTO Board of Directors approving supplemental funding for LTPP.

## The Future

In 2000, LTPP will continue to work toward FHWA's goal of improving the productivity and mobility of the national highway transportation system by providing answers to how and why pavements perform as they do. Highlights of efforts in each of LTPP's program areas in 2000 include:

### Data

In 2000, LTPP will continue to implement its monitoring adjustments. These adjustments will help FHWA, along with the States and Provinces, to use their resources more efficiently and to help LTPP to improve the quality and quantity of the types of data it needs to achieve its objectives. In addition, FHWA, the TRB-LTPP Committee, AASHTO, and all the LTPP partners will be working together to implement plans to resolve traffic data issues.

### Analysis

In 2000, national analysis efforts focusing on LTPP data will continue to be a shared responsibility between FHWA and NCHRP. FHWA will continue its systematic review and analysis of LTPP data. In addition to completing ongoing analyses (see page x, LTPP Analysis Projects Ongoing in 1999), FHWA plans to initiate the following analyses: Review of LTPP Layer Thickness Data, Evaluation of LTPP

Climatic Data, and Review of Verification of Strategic Highway Research Program Asphalt Specification and Mix Design.

Planned NCHRP 2000 analysis efforts include: Effects of Pre-Rehabilitation Roughness on the Rate of Deterioration of Overlaid Pavements, Variation of AC Air Voids as a Function of Specifications and Its Significance to Performance, Feasibility of Using Falling-Weight Deflectometer Data for Rapid Field Characterization of Pavement Quality, Significance of Traditional Material Pay Factors to Pavement Performance, Moisture and Temperature Effects on Material Properties, Common Characteristics of Good- and Poor-Performance Pavements, Guidelines for Operating and Maintaining Reliable Pavement Traffic Loading Data Collection, and Quantifying the Benefits of Accurate Pavement Traffic Loading Data.

## Products

Potential LTPP product projects recommended by the TRB-LTPP Committee and approved by AASHTO for funding for 2000 include: Manuals and National Workshop on Pavement Smoothness, PCC Pavement Practice Manual and Workshop, Guide for Determining Design Resilient Modulus Values for Soils, Guidelines for Temperature Adjustment of FWD Test Results, and Seasonal Monitoring Program CD-ROM.

## Communication & Coordination

In 2000, FHWA will also continue to explore new venues for keeping LTPP partners and customers up-to-date on its work and research results. In April 2000, LTPP will host a Special Pavement Studies Workshop in Newport, Rhode Island. The focus of the workshop will be to discuss the current status of several Special Pavement Studies, to review program changes and issues (e.g., monitoring adjustments, traffic issues, and experimental variables), and to get input from the States and Provinces regarding analysis and product projects.