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U.S. Department of Transportation

Federal Highway Administration

LTPP: Year in Review 2000

I N T R O D U C T I O N

Whether it is for moving people or goods, or whether it is to support local activities or national trade and tourism, the quality of pavements is an integral part of the quality of life in America. The Long Term Pavement Performance (LTPP) program is a major contributor toward ensuring that our Nation will have good pavements into the 21st century. LTPP answers key questions about pavement design characteristics that will help the States and Provinces achieve pavement performance that is both long-lived and cost-effective.

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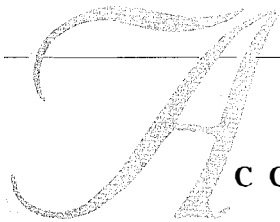
To year and this trend in 2000 LTPP continued to play a critical role in the development of the *2002 Guide for Design of New and Rehabilitated Pavement Structures* by the National Cooperative Highway Research Program (NCHRP). LTPP data is being used to validate and calibrate performance models for the guide. This is one of the most important elements in developing the guide as it helps demonstrate to the user community that the models/technologies being developed truly match real-world problems. LTPP also funded a pooled fund study to increase the quality and quantity of monitored traffic data in 2000. The study seeks to obtain the data needed to quantify the relationship between pavement performance and truck volume and axle load. In turn, quantifying this relationship will help the highway community predict the long-term performance of Interstate and other major highways.

LTPP also completed several data analysis projects in 2000. The findings from one of these studies assisted in the development of Profile Viewer software. This software facilitates review of the LTPP profile data making it easy to compare profile data from different profile runs. Another project confirmed that agencies can use monthly available National Climatic Data Center weather data to

obtain reliable estimates of site-specific climatic conditions.

In 2000, LTPP also continued to maintain and, where possible, augment its current product offerings, such as DataPave 2.0, LTPPBind, Falling-Weight Deflectometer technology, and Resilient Modulus Testing. In addition, to address the need for a formalized product development and delivery process, the Federal Highway Administration (FHWA), in cooperation with the Transportation Research Board (TRB)-LTPP Committee, developed the LTPP Product Plan. The plan establishes a process in which products are identified during the research phase, carried through the product development phase, and ultimately delivered to highway agencies and industry via the Resource Centers and Division Offices.

For a State, Province, county, or toll agency to effectively manage their pavements, they need reliable data in order to make intelligent decisions. As in previous years, in 2000, LTPP worked to provide this kind of data and information to its customers and partners. The purpose of this report is to outline the program's 2000 accomplishments in each of its program areas and to provide an overview of key initiatives that LTPP will be pursuing in 2001.



ACCOMPLISHMENTS 2000

In 2000, LTPP completed an effort to resolve issues and questions associated with a portion of the LTPP data. LTPP's data resolution effort—a cooperative effort among the States, Provinces, American Association of State Highway and Transportation Officials (AASHTO), TRB-LTPP Committee, and FHWA—resulted in a significant increase in LTPP data, adjustments to the monitoring schedules for the LTPP sections, and the inception of a pooled-fund traffic data collection study.

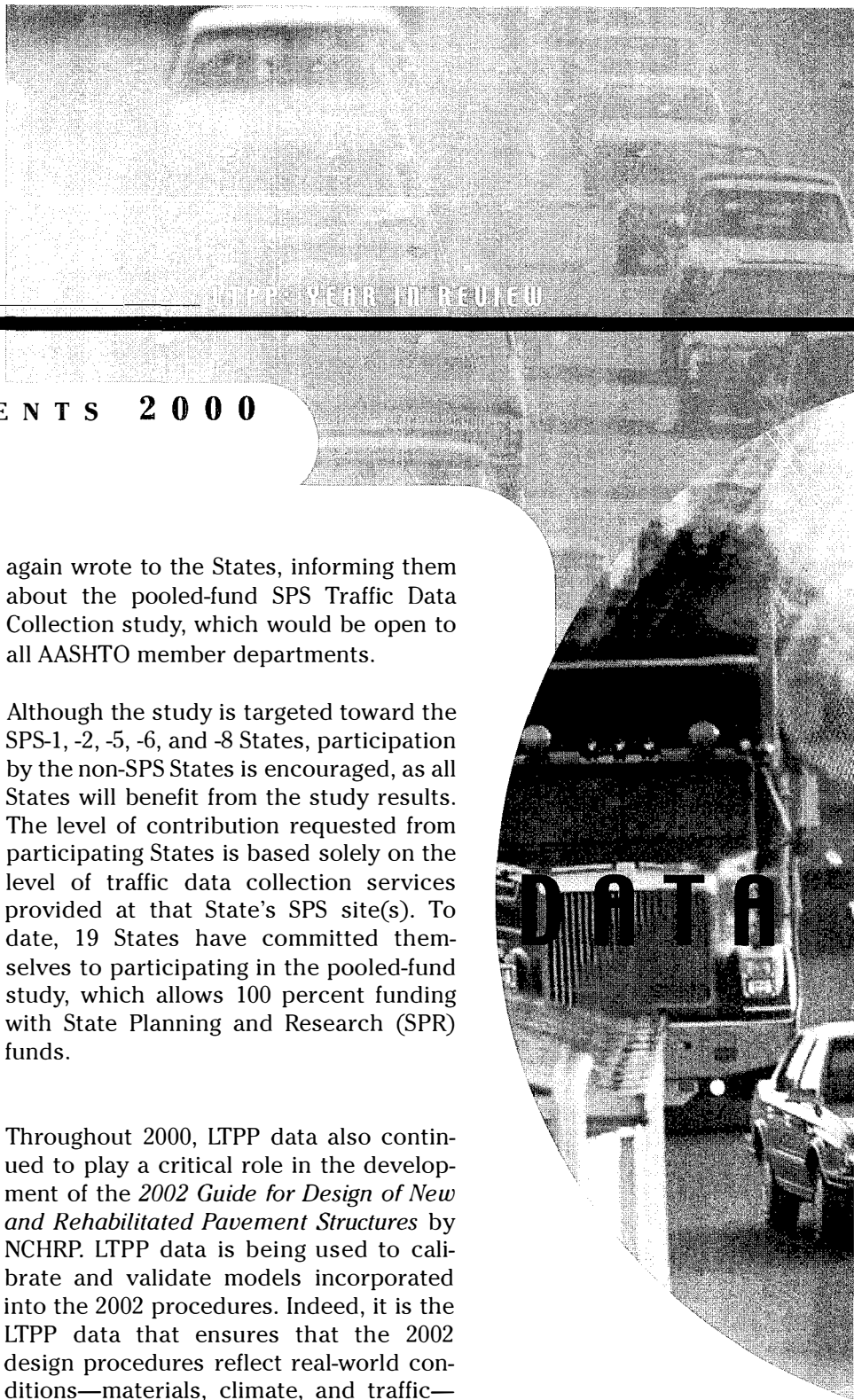
LTPP initiated the pooled-fund traffic data collection study to address the need for traffic data. The goal of this study is to increase the quality and quantity of monitored traffic data—volumes, classifications, and weights—from the program's Specific Pavement Studies (SPS) projects (SPS-1, -2, -5, -6, and -8).

Throughout 1999, FHWA worked with the TRB-LTPP Committee and the TRB-LTPP Traffic Expert Task Group to develop a plan to improve SPS traffic data. In November 1999, the TRB-LTPP Committee agreed on a recommended traffic data collection plan. In February 2000, the AASHTO Task Force on Strategic Highway Research Program (SHRP) Implementation sent the plan to the Chief Engineers of the SPS States. In August, AASHTO

again wrote to the States, informing them about the pooled-fund SPS Traffic Data Collection study, which would be open to all AASHTO member departments.

Although the study is targeted toward the SPS-1, -2, -5, -6, and -8 States, participation by the non-SPS States is encouraged, as all States will benefit from the study results. The level of contribution requested from participating States is based solely on the level of traffic data collection services provided at that State's SPS site(s). To date, 19 States have committed themselves to participating in the pooled-fund study, which allows 100 percent funding with State Planning and Research (SPR) funds.

Throughout 2000, LTPP data also 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 is being used to calibrate and validate models incorporated into the 2002 procedures. Indeed, it is the LTPP data that ensures that the 2002 design procedures reflect real-world conditions—materials, climate, and traffic—and that the performance prediction models accurately depict the performance of in-service pavements.



The year 2000 brought substantial progress in the national-level analysis of the LTPP data. FHWA analysis contractors completed nine data review projects. Key outcomes of this work include:

Improvements in the overall quality of the LTPP database arising from the identification and correction (to the extent possible and appropriate) of data problems not caught by the automated quality control process.

Confirmation that the virtual weather station concept used to estimate site-specific climatic data from the National Climatic Data Center is, in fact, sound. The implication of this finding is that highway agencies can use readily available climatic data to estimate climatic conditions at a particular site.

Quantitative information on the accuracy and repeatability of pavement rutting data obtained with 3- and 5-point rut bar systems. This information is critical to agencies using, or considering the use of, automated rut bars to monitor pavement rutting.



ANALYSIS

Profile Viewer software developed to facilitate review of LTPP profile data, making it easy to compare profile data from different profile runs. This tool has the potential of being very useful in the evaluation of profile data that was collected for pavement management. However, further development is needed to create a distribution-quality software package.

Algorithm developed as part of the review of LTPP deflection data. This useful tool checks Falling-Weight Deflectometer data for accurate deflection sensor positions and estimates the correct position when errors are found.

In addition, ongoing FHWA analysis projects have yielded preliminary procedures for estimating (forecasting and backcasting) traffic axle loads and have resulted in substantial improvements to the moisture-predictive capabilities of the Integrated Climatic Model.

Eight fiscal year (FY) 1999 and 2000 NCHRP-LTPP data analysis projects were ongoing. One additional FY 2001 project is pending. Information on those projects may be found at www4.nationalacademies.org/trb/crp.nsf/NCHRP+projects, under Area 20, Special Projects.

Work toward a programmatic approach to LTPP data analysis continued. At their October 2000 meeting, the TRB Expert Task Group on LTPP Data Analysis further defined a program of national-level analysis of LTPP data. The LTPP Data Analysis

Program (hereafter known as “the program”) developed by the Expert Task Group encompasses the analysis work to be directly sponsored by FHWA, as well as work to be proposed for pursuit via NCHRP, pooled-fund initiatives, and other entities. The program is the culmination of several years of effort on the part of the Expert Task Group and others. The majority of the LTPP data analysis projects that com-

prise the program were defined through a series of annual workshops, starting in 1998, that were sponsored by TRB. The remaining projects (those sponsored directly by FHWA) were defined through FHWA data analysis planning efforts commencing in 1997. The program addresses the needs defined in the November 1999 Strategic Plan for Long Term Pavement Performance Data Analysis.

FHWA LTPP DATA ANALYSIS PROJECTS

Completed in 2000

Study of Longitudinal
Profile Variability

Study of Transverse
Profiles

Study of LTPP Deflection
Data

Production of a Computational
Data Set for Distress Analysis

Study of LTPP Pavement
Temperatures

Review of the Structural Factors
and Rehabilitation Experiments

Review of the LTPP Maintenance
and Rehabilitation Data

Review of Laboratory Materials
Data

Evaluation of LTPP Climatic Data

Review of Dynamic Load-
Response Data

Ongoing in 2000

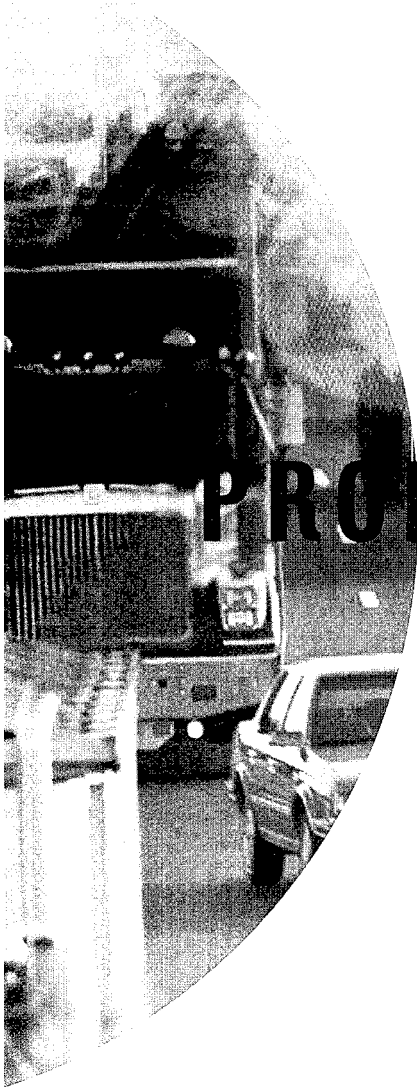
Seasonal Variation in
Unbound Pavement
Materials

Traffic Backcasting

Initiated

Review of Laboratory
Resilient Modulus Data for
Unbound Materials

Review of LTPP Layer
Thickness Data



PRODUCTS

In 2000, LTPP's product focus continued. The TRB-LTPP Product Subcommittee, which was formed in 1999 to address the need for a formalized product development and delivery process, met three times. Through their efforts, an LTPP Product Plan was completed and accepted by the TRB-LTPP Committee.

The plan identifies key roles and responsibilities for all organizations and committees involved in the LTPP product process, establishes a formal product identification and tracking system, and specifies a reporting mechanism for product effectiveness. The plan includes key roles for the Product Subcommittee, the Expert Task Groups, and FHWA's Office of Pavement Technology, as well as the LTPP research program staff.

The year 2000 also saw the identification of nearly 30 additional products that could be developed from LTPP that will directly meet the needs of the State departments of transportation (DOTs). The TRB Expert Task Groups, the FHWA staff, and the par-

ticipants in the September 2000 Analysis Workshop recommended these potential products.

LTPP continued to maintain and augment, where possible, its current product offerings in 2000. These included DataPave 2.0, LTPPBind, Falling-Weight Deflectometer Technology, Resilient Modulus Testing, and Portland Cement Concrete (PCC) Pavement Design Procedures. The following products are currently under development via NCHRP and will be available in 2001: National Workshop on Pavement Smoothness, PCC Pavement Practice Manual and Workshop, Seasonal Monitoring Program CD-ROM, Guide for Determining Design Resilient Modulus Values for Soils, and Guidelines for Temperature Adjustment of Falling-Weight Deflectometer Test Results.

To help its partners and customers better understand its current product offerings, LTPP participated in FHWA's Pavement Technology Delivery Workshop in Olympia Fields, Illinois, in March 2000. The workshop focused on providing FHWA's Resource Centers with the materials and knowledge to make pavement engineers and managers aware of key products in the LTPP and pavement technology arenas.

GETTING THE WORD OUT

LTPP announces research results through meetings; publications; its web-site; and working in cooperation with State highway agencies, industry trade associations, and professional societies. In 2000, LTPP continued to spread the word about the program and its results through as many venues as possible.

MEETINGS

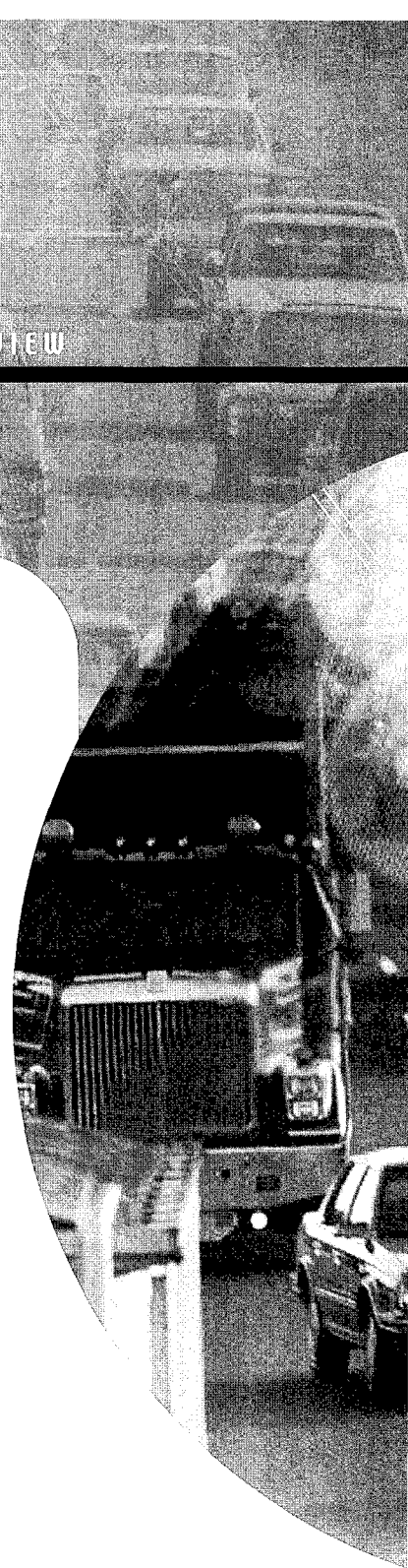
Each year, FHWA LTPP staff and contractors make presentations at various industry trade association and government meetings throughout the United States. In 2000, these activities included the LTPP Box Session, State Coordinators Meeting, LTPP International Coordinators Meeting, and several other LTPP presentations at the 2000 TRB annual meeting. Later in January, LTPP also made a presentation at the Spring Seminar Series of the Midwest Transportation Consortium. In August, LTPP presented "Setting Standards for Research Quality Data at LTPP SPS Sites" and "LTPP Expectations for Traffic Data" at the North American Travel Monitoring Exhibition and Conference 2000, and they exhibited at AASHTO's annual meeting in December.

WORKSHOPS/CONTESTS

LTPP participated in several workshops in 2000. Beginning in March, LTPP made

several presentations at FHWA's Pavement Technology Delivery Workshop in Olympia Fields, Illinois. The workshop brought together staff from the FHWA Resource Centers, Division Offices, and Headquarters to learn about the different kinds of products that FHWA has to offer the States. In April, LTPP held a workshop in Newport, Rhode Island, on the status of the program's SPS-1, -2, -5, and -6 experiments. Nearly 150 participants were on hand to discuss the progress of these experiments, which were designed to explore how climate and cumulative traffic loading affect pavements of different compositions and cross-sections. In September, TRB-LTPP Workshop 2000 focused on identifying the next logical steps needed for LTPP data analysis and product development activities to achieve the goals of the 1999 Strategic Plan for Long Term Pavement Performance Data Analysis.

LTPP and the American Society of Civil Engineers (ASCE) also awarded the grand prize for its inaugural LTPP DataPave contest in 2000. Christopher Byrum, a civil engineering student at the University of Michigan at Ann Arbor, received the award for his paper "The Effect of Locked-In Curvature on PCC Pavement." Later in the year, LTPP and ASCE announced the winners of the second annual DataPave contest and kicked-off the third annual LTPP DataPave contest.





PUBLICATIONS

Findings from LTPP analysis projects help highway engineers in their day-to-day operations. To keep the highway community apprised of the results of LTPP's analysis efforts over the past several years, LTPP published a 16-page document entitled, *Key Findings From LTPP Analysis, 1990-1999*. In addition, to provide an overview of the role LTPP plays in the development of the *2002 Guide for Design of New and Rehabilitated Pavement Structures*, LTPP published a six-page document entitled, *LTPP and the 2002 Pavement Design Guide*. The document provides a simple, straightforward explanation of LTPP's role in a question-and-answer format.

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 2000. 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 Resource Centers, members of TRB committees advising LTPP, and other interested parties. Reports documenting significant findings of interest to a more 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

In 2000, LTPP redesigned its website to make it easy for users to access and navigate the site. Now users will find much more information on LTPP products, including Product Briefs, PowerPoint® presentations, and how to obtain the product. In the Analysis section, users can review the strategic plan or see what projects are currently being undertaken. Similarly, LTPP's analysis findings can easily be accessed from the Library section, along with LTPP's resource documents, brochures, TechBriefs, Product Briefs, and Application Notes. Want to know when the next meeting is being held? Just click on the Communications section and go into the Calendar. As before, LTPP's website is intended to provide information on the program's ongoing research activities and the products and reports that result from these activities.





LTPP: YEAR IN REVIEW

FUNDING

Approximately \$8.7 million of LTPP's funding in 2000 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. 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 approximately \$5 million in NCHRP funding for LTPP in FY 2000.

Approximately \$7.5 million of the TEA-21 funds, along with \$3.1 million of the NCHRP funds, were used for LTPP data collection field operations in 2000. 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 2000, along with \$950,000 from NCHRP funds. In terms of product development, \$100,000 came from TEA-21 funds and \$750,000 from NCHRP funds. Similarly, for communication and coordination activities, \$440,000 was allocated from TEA-21 funds, with \$225,000 coming from NCHRP.

At the Spring AASHTO meeting, the FY 2001 NCHRP budget for LTPP was approved. Approximately \$3.5 million of NCHRP funding was approved, of which \$3.1 million is allocated for data collection field operations, \$150,000 is allocated for data analysis projects, \$100,000 is allocated for product development (contingent upon available funds), and \$200,000 is allocated for coordination and communication activities.

T

HE PARTNERSHIP

LTPP is a partnership. The State and Provincial highway agencies, TRB, AASHTO, the Canadian Strategic Highway Research Program (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.

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 Expert Task Groups that provide technical review and input for key program areas. The dedicated service of the volunteers who serve on these committees is a tremendous asset to LTPP.

In 2000, a few changes were made to the TRB-LTPP Committee's structure. Specifically, a new subcommittee and Expert Task Group were established. The subcommittee will focus on issues associated with planning to complete the LTPP mission and the

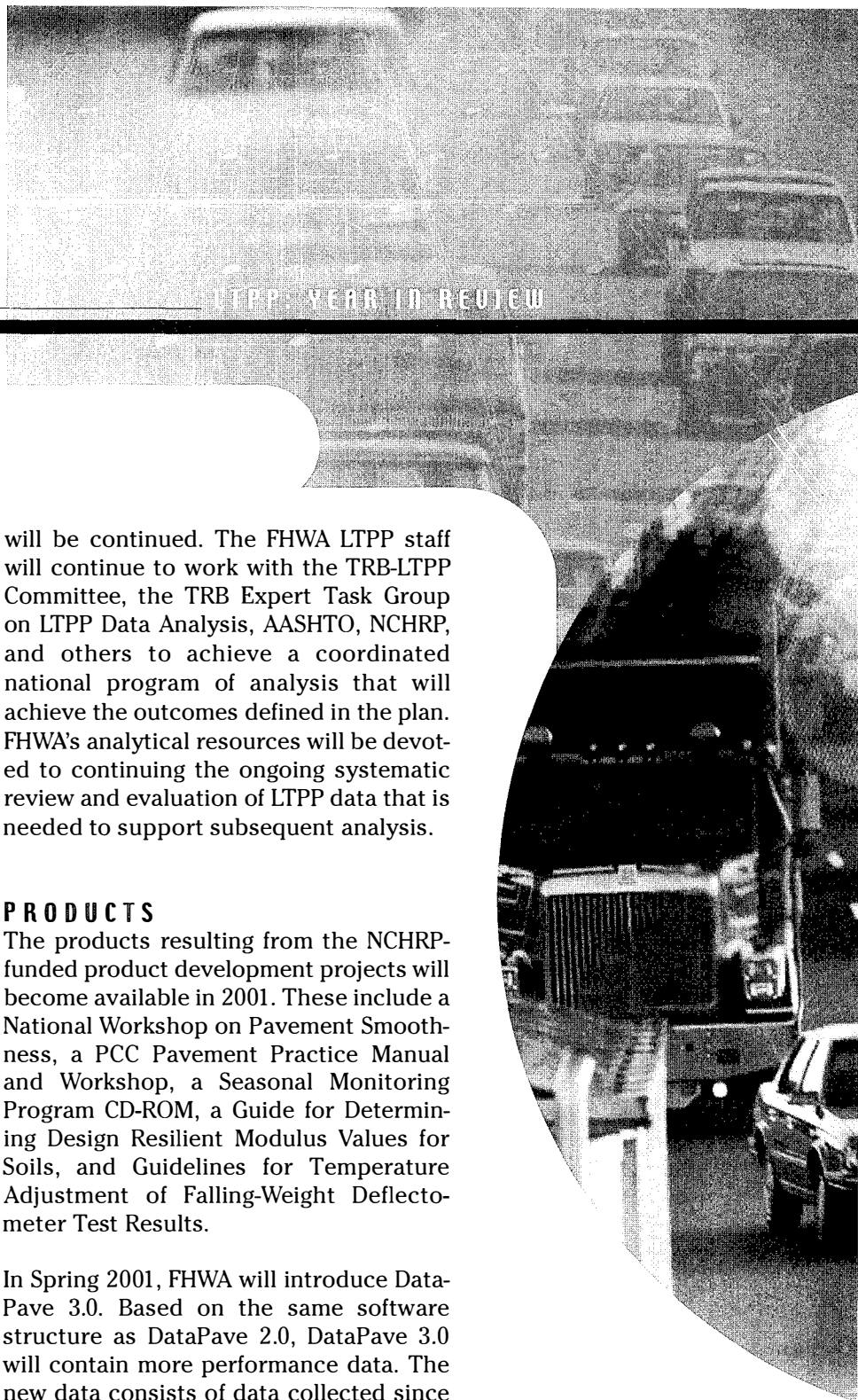
identification of current and future benefits of the program. The new Expert Task Group will provide technical guidance on materials-related issues, including data collection, falling-weight deflectometer testing, analysis, and related products.

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 SHRP 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.

FEDERAL HIGHWAY ADMINISTRATION

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



LTPP: YEAR IN REVIEW

THE FUTURE

In 2001, LTPP will continue to provide its customers and partners with the reliable data that they need to design pavements that will meet their performance expectations. Highlights of efforts in each of LTPP's programmatic areas for 2001 include:

DATA

In 2001, LTPP will 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. During the first half of the year, FHWA LTPP staff will hold meetings with each of the SPS-1, -2, -5, -6, and -8 States to explain the specifics of the proposed study, the SPS site evaluations, implementation of pilot projects, and LTPP's policy on the quality of traffic data.

Another major activity for 2001 will be the awarding of four LTPP regional data collection contracts. Data—collection, processing, quality control, and coordination—represents the largest financial component of the LTPP program and the resulting data forms the basis for analysis and product development. These four regional contracts are responsible for the majority of LTPP data collection.

ANALYSIS

In 2001, a programmatic approach to achieving the objectives defined in the 1999 Strategic Plan for LTPP data analysis

will be continued. The FHWA 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 achieve 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 is needed to support subsequent analysis.

PRODUCTS

The products resulting from the NCHRP-funded product development projects will become available in 2001. These include a National Workshop on Pavement Smoothness, a PCC Pavement Practice Manual and Workshop, a Seasonal Monitoring Program CD-ROM, a Guide for Determining Design Resilient Modulus Values for Soils, and Guidelines for Temperature Adjustment of Falling-Weight Deflectometer Test Results.

In Spring 2001, FHWA will introduce DataPave 3.0. Based on the same software structure as DataPave 2.0, DataPave 3.0 will contain more performance data. The new data consists of data collected since the release of DataPave 2.0 and several new computed parameters. DataPave 3.0 will be available on a CD-ROM set or it can be downloaded from the LTPP website. Future updates to DataPave will be avail-



able on the LTPP website, along with other data access services.

Two other products will also be introduced in 2001. They are an improved start-up procedure for resilient modulus testing and a software tool for estimating site-specific climatic data. This software, based on an LTPP weather station procedure, provides ready access to a wide

array of climatic data for use in pavement design, research, forensics, and construction scheduling.

COMMUNICATION & COORDINATION

In 2001, FHWA will also continue to explore new venues for keeping LTPP partners and customers up-to-date on its work and research results.