

LONG-TERM PAVEMENT PERFORMANCE PROGRAM



YEAR IN REVIEW

2007

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U.S. Department of Transportation
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LTPP

2007 Year in Review

INTRODUCTION

Improving mobility on our Nation's highways is the mission of the Federal Highway Administration (FHWA). During 2007, FHWA's Long Term Pavement Performance (LTPP) program worked toward this mission through its efforts to provide answers to "how" and "why" pavements perform as they do. To better understand pavement performance, the LTPP program gathers and processes data describing the structure, service conditions, and performance of 2,513 pavement test sections in North America. Highway engineers use these data and data analysis findings to help make decisions that lead to more cost effective and better performing pavements.

The LTPP program was designed as a partnership when it was initiated as a 20-year Strategic Highway Research Program (SHRP) project in 1987. The State and Canadian Provincial highway agencies, the American Association of State Highway and Transportation Officials (AASHTO), the Transportation Research Board (TRB), the Canadian Strategic Highway Research Program, and FHWA all continued to play key roles in helping the program achieve its goals in 2007. These partners stay informed about research results and other program activities through the LTPP Web site, e-mail newsletter, publications, meetings and workshops, industry trade associations, and professional societies.

2007 ACCOMPLISHMENTS

LTPP Standard Data Release #21

LTPP made available the latest edition of the pavement performance database in Standard Data Release (SDR) #21. The SDR is available on a single DVD-ROM or as a five-CD-ROM set and contains the most current pavement performance data in zipped Microsoft® Access™ database files. Along with the complete LTPP pavement performance database, the SDR contains the Database User Reference Guide, tutorial, and other information about the database, including what is new since the previous release. The SDR also includes an application and manual for Table Navigator, which features definitions for database fields and codes and enables users to expand, collapse, and search the LTPP database structure. In addition, a Reference Library CD with documentation for the LTPP program is provided with the SDR. For more information or to obtain a copy of the SDR, contact LTPP Customer Support Services at ltppinfo@fhwa.dot.gov or call 202-493-3035.

Materials Action Plan

In 2006, FHWA developed a materials action plan (MAP) to fill the gaps in the Specific Pavement Study (SPS) materials data. The MAP involves the following activities: (1) development of material sampling plans by LTPP regional support contractors (RSC) to fill project gaps, (2) acquisition of material samples by State departments of transportation and LTPP regional contractors, and (3) testing of material samples by the LTPP material testing contractor. FHWA has completed all of the sampling, and testing is estimated to be completed during 2008. The LTPP Materials Tracking System contains more than 6,500 samples, and over 5,400 test results have been loaded in the database. FHWA also is storing material samples at the Materials Reference Library in Reno, NV, for future testing.

LTPP Data Collection

Collection of pavement performance data is continuing at LTPP test sections. Data collection includes distress, profile, and falling weight deflectometer (FWD). Weather data are also being collected at various SPS projects. State and Canadian Provinces' highway agencies are asked to maintain the test sections until told otherwise by the LTPP RSC.

LTPP Customer Support Service Center

The LTPP Customer Support Service Center (CSSC) was established in December 1997 to provide a single point of contact for LTPP data and information requests. The CSSC provides technical assistance and guides users to needed information. In 2007, LTPP received more than 500 requests for data, software tools, resource documents, research reports, and other information. The CSSC can be contacted at ltpinfo@fhwa.dot.gov or by calling 202-493-3035.

Profiler Rodeo Held at MnROAD Site

Profile data at LTPP sections are collected by four RSCs, who use an International Cybernetics Corporation (ICC) MDR 4083 inertial profiler. These profilers are equipped with three laser sensors that collect data along the left and right wheel paths and along the center of the lane at 25-mm intervals.

During May 14–18, 2007, researchers performed a comparison test among the four ICC profilers used by the LTPP RSCs. The comparison test was performed at the Minnesota Road Research Project (MnROAD) facility in Albertville, MN. Five test sections were used for profile testing, and one test section was used to evaluate the accuracy of the distance measuring instrument (DMI).

The objectives of the profiler comparison test were to (1) evaluate the static accuracy of the height sensors in the profilers, (2) evaluate the results from the bounce test, (3) evaluate the accuracy of the DMI, (4) compare International Roughness Index (IRI) values obtained by the LTPP profilers with those from the Dipstick®, (5) compare the IRI values among the four profilers, and (6) compare the profiles obtained by the profilers. A report summarizing the activities conducted during the comparison test and the resulting data from the comparison between the LTPP profilers are available through the LTPP CSSC.

Data Analysis

Two LTPP data analysis studies were completed and four are now underway. These include:

- *LTPP Computed Parameter: Moisture Content 07/01/05–12/31/07*
This project completed the interpretation of LTPP time domain reflectometry measurements and provided estimates of moisture contents from these measurements in the LTPP Pavement Performance Database, available in January on SDR #22.

- *LTPP Computed Parameter: Frost Penetration* 07/01/05–06/31/07
 With the completion of monitoring measurements on the Seasonal Monitoring Program sections in October 2004, this project addresses the need to complete the interpretation of measurements not previously interpreted and adds the results of these interpretations to the database. These results will be available from the LTPP CSSC in early 2008.
- *LTPP Benefits Study* 12/08/06–4/30/08
 This project will detail the benefits that have been derived and to be derived from the LTPP program, including benefits realized through the performance data collection activities and conduct of the analysis work. Specific areas of focus include the evaluation and development of design methods and equations; rehabilitation strategies; determination of the effects of loads, environment, material properties and variability, construction quality, maintenance levels, and specific design features; and the establishment of a national long term pavement database to support future needs.
- *Estimation of Key Portland Cement Concrete, Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics* 08/13/07–10/13/09
 This project will yield information that will enable pavement design and materials engineers to make well-founded decisions about material and material specifications to be used in pavement construction. Potential cost savings resulting from better materials selection, fewer premature pavement failures, or avoidance of overdesign are significant.
- *LTPP Computed Parameter: Dynamic Modulus* 08/17/07–09/30/09
 The primary objective of this study is to develop estimates of the dynamic modulus of hot mix asphalt layers on LTPP test sections following the models used in the National Cooperative Highway Research Program Guide for Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures (M-E PDG) for storage in the LTPP Pavement Performance Database.
- *Impact of Design Features on Pavement Response and Performance in Rehabilitated Flexible and Rigid Pavements* 08/13/07–09/30/09
 With new data available in the LTPP database, it is necessary to obtain more understanding of the effects of design and construction features on pavement response and performance of rehabilitated flexible and rigid pavements. This research will provide preliminary information on the relationship between pavement response and performance, guidance for identifying appropriate features for different pavement types, and recommendations for improving data collection activities.

POOLED FUND STUDIES

The FHWA sponsors the Transportation Pooled Fund (TPF) Program as a way for FHWA, interested States, and other organizations to partner when significant or widespread interest is shown in solving transportation-related problems. Partners may pool funds and other resources to solve these problems through research, planning, and technology transfer activities. One LTPP-related pooled fund study was completed and three are now underway. These include:

SPS Traffic Data Collection Pooled Fund Study

This multiyear study to collect research quality traffic data is underway. In 2007, data were collected from 21 SPS test sites throughout North America. A few more SPS sites will be installed with a new weigh-in-motion (WIM) system within the first quarter of 2008. Thus, the remaining years of the study will be focused on maintaining the WIM systems and frequently checking the data to ensure quality and integrity.

The approved WIM technologies used for this study are bending plate, load cell, and quartz sensor. Two of the SPS sites are instrumented with a load cell WIM system with the remaining test sites evenly instrumented with a bending plate or quartz WIM system. This study not only has standardized the type of equipment that can be installed at these high-priority LTPP test sites but also has standardized the scheme used for classifying vehicles at the sites installed by the installation contractor. Highway agencies that installed their own WIM sites are strongly encouraged to use this same scheme for classifying vehicles at their SPS sites. This will allow for consistency in classifying vehicles. The data collected from the sites are downloaded and checked daily for accuracy then processed each week with the LTPP traffic analysis software. TPF-5(004): [LTPP SPS Traffic Data Collection](#).

FWD Calibration Center Improvement Pooled Fund Study

Many State highway agencies expressed interest in updating the FWD calibration software and equipment and in establishing a long term plan for support of the calibration facilities and their services after the LTPP program ends in 2009.

In September 2004, Cornell University received the contract to perform this work, which involved updating the calibration hardware, software, and procedures, as well as training and installing the new calibration system in the four SHRP/LTPP calibration centers in Colorado, Minnesota, Pennsylvania, and Texas. This first phase is complete, and a draft final report is available at the Web site listed below. Work to be conducted during the next phase includes equipping two additional calibration centers in California and Indiana, providing technical support, performing quality assurance audits, developing an FWD data collection guide and a calibration video, holding a backcalculation workshop, and providing training and certifications for FWD calibration center operators and FWD operators. TPF-5(039): [Falling Weight Deflectometer \(FWD\) Calibration Center and Operational Improvements](#).

Improving the Quality of Pavement Profiler Measurement Pooled Fund Study

Many reports and studies have indicated that a need exists to bring integrity to data collection for ride quality by establishing calibration processes and verification procedures. AASHTO has developed provisional standards to assist highway agencies with the implementation of quality assurance programs relating to ride quality data collection. FHWA initiated this pooled fund study to assist with the implementation of the AASHTO provisional standards and to establish a level of integrity for the measurements.

One of the main objectives of this multiyear, multitasked study was to deliver a profile analysis software program. The Profile Viewing and Analysis (ProVAL) software enables users to view and analyze pavement profiles collected by pavement profile measurement equipment. Different equipment manufacturers use different data formats and standards,

making it difficult to compare profiles collected by diverse brands of equipment. ProVAL is the first and only software application that can read data from numerous pavement profilers and unify them using a common data format.

Since its debut in 2001, ProVAL has consistently and continuously been improved to meet users' needs. The recent news about ProVAL is that, after almost 4 years in the making, the ProVAL native data format is now an ASTM International Standard, "E 2560-07: Standard Specification for Data Format for Pavement Profile." TPF-5 (063): [Improving the Quality of Pavement Profiler Measurement](#).

Effect of Multiple Freeze Cycles and Deep Frost Penetration on Pavement Performance and Cost Pooled Fund Study

This study was completed in November 2006, and the final report was printed in 2007. The report documents the study, which evaluated pavement deterioration in various environmental settings. In addition, the report documents local adaptations in use to mitigate frost-related damage and the cost differences associated with constructing and maintaining pavements in various climates.

The researchers used performance models developed from the LTPP database to predict and compare performance in various environments. As described in the report, the prediction models are an important tool in the calibration process outlined in the M-E PDG and in pavement management applications for State highway agencies with limited quantities of regional performance data. Final Report: [Long-Term Pavement Performance \(LTPP\) Data Analysis Support: National Pooled Fund Study TPF-5\(013\)](#), FHWA-HRT-06-121.

LTPP PRODUCTS

Products Online

In early 2007, the LTPP program expanded on the DataPave Online concept and released a new one-stop shopping Web site called LTPP Products online (www.ltpm-products.com). Since then a number of online applications have been added such as: Distress Viewer and Analyzer (Diva) application; a utility software, ESALCalc, to assist LTPP database users with calculating Equivalent Single-Axle Load (ESAL); and Pavements online (Rigid Pavement Design application, WIM Cost Estimator and ERD Builder). The LTPP products team is working to add future applications.

The LTPP DataPave Online Web site registered a total of 443 new users in 2007. A total of 5,269 data exports were performed during this period. The volume of data exported was 3.6 gigabytes. The most requested data were from the Monitoring module of the Pavement Performance Database and the most exported file format was Microsoft® Excel.

Distress Viewer and Analyzer (Diva Online)

Diva is a software application that can overlay distress information for analysis. It is linked to the LTPP distress survey maps, photographs, and PASCO digital images. It can also graphically display time series data of pavement distress for trend analysis and display

variability bands for distress trends. The application can analyze several survey sections at the same time.

AASHTO MP 14-05

The provisional specification for “Smoothness of Pavement at the Approaches to WIM Scales” was granted provisional status once again by a unanimous vote. Work will continue in 2008 to further refine the lower threshold of the Long Range Index to be more pragmatic.

Traffic Data Inputs for the M-E PDG

A workshop was held in New Brunswick, NJ, on August 21–22 that focused on obtaining and inputting quality traffic data for the M-E PDG. The LTPP traffic analysis software (LTAS) was demonstrated to the participants and is now available through the LTPP CSSC as an unsupported product. Future workshops are planned to assist the practitioner in the efficient use of LTAS.

Portable Pavement Reference Device

A contract was awarded to develop a prototype of a quality Portable Pavement Reference Device (PPRD) using the Vehicle Terrain Measurement System. Many highway agencies have been using these pavement profile measuring devices for contract monitoring and compliance, but there is currently no reliable and repeatable way to check their performance. This contract will develop a tool that can be used as a quality assurance measure to verify and validate the precision and accuracy of these devices.

LTPP/American Society of Civil Engineers International Data Analysis Contest

In 2007, the LTPP products team sponsored the annual LTPP/American Society of Civil Engineers International Contest on LTPP Data Analysis. The contest encourages university students, professors, and highway department engineers from around the world to get involved in using the LTPP database. There were 12 papers submitted. The awards for the different categories will be presented during the LTPP State Coordinators’ Meeting on January 13, 2008, at the TRB Annual Meeting. We encourage all levels of participation including highway agencies and contractor personnel individually or in teams to submit papers for next year’s contest. For more information, visit www.fhwa.dot.gov/pavement/ltpplcontest2007.cfm.

Products Workshops

- ***New DataPave Professors Workshop***

In 2007, work began to develop a workshop modeled on the 2001 DataPave workshop for professors held in Reno, NV. This new workshop will take into consideration the many changes in DataPave Online since then and add case studies showing professors what can be done with the data supplied by DataPave Online. The project is expected to be complete by spring 2008.

- ***Calibration and Validation of WIM Systems Workshop***

Development began of a workshop to provide highway agencies with guidance on methods of establishing the quality of WIM systems and the resulting traffic data collected. Quality data are essential for pavement design programs, national reporting, and research studies. The LTPP Calibration and Validation procedures used in the SPS Traffic Data Collection pooled fund project TPF-5(004) forms the nucleus of the workshop. An AASHTO specification for Calibration and Validation of WIM Systems is also being drafted in conjunction with the Subcommittee on Materials.

THE FUTURE

Planning for Transition

In 2007, FHWA management began planning for the transition of the program past 2009 so that some of the activities not completed by this date can be completed in some formal capacity after the official end of the program. FHWA wrote a post-2009 document that addresses such questions as what happens to the LTPP test sites that have not reached the end of their design life, and how do we keep the LTPP database current with technology so that it is available to generations to come? FHWA management in collaboration with the TRB LTPP Committee is working on possible solutions to address these and other issues identified in the post-2009 document. The document is in final draft. For more information, contact Aramis López at aramis.lopez@fhwa.dot.gov or 202-493-3145.

The schedule associated with planned LTPP activities under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation is as follows:

- Pavement performance monitoring activities will be completed by December 31, 2008.
- SPS materials and traffic data collection activities will continue through and in some cases beyond 2009. The inclusion of those data collected in fiscal year 2009 or later into the database is part of the post-2009 document.
- LTPP will complete the update of the virtual weather data in the database during 2008.
- The final upload of regional data to the national database under SAFETEA-LU will take place during the first quarter of 2009. LTPP will dedicate the remaining three quarters of 2009 to the final review and quality control/quality assurance checks of the data contained in the database prior to its last release in the fall of 2009.
- LTPP program funding under SAFETEA-LU continues through September 30, 2009.

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