The LTPP program relies on data collected by weigh-in-motion systems that measure the traffic stream

The LTPP program receives and analyzes data from weigh-in-motion systems that measure traffic streams. For example, weigh-in-motion measurements collected at one location in Arizona found that traffic loads were much lower than would be typically expected based on their standard design tables. By adjusting the pavement design to reflect these lower traffic loads, the Arizona Department of Transportation was able to save more than $2 million and was then able to put those savings to work on other high-priority highway projects.[vi]

Selected Standards and Tools Founded on LTPP Practices

Standard or Tool	Application	LTPP Contribution
Weigh-in-Motion	Collection of reliable traffic loading and classification data	Developed standard calibration procedures and processes
Highway Performance Monitoring System (HPMS) database requirements for ride, cracking, faulting, and rutting data	Highway Performance Monitoring System	Developed LTPP definitions for ride, cracking, faulting, and rutting data that provided the basis for these requirements
ProVal Software	Review and processing of pavement profile data to monitor and evaluate pavement roughness	Developed prototype software as part of an LTPP data analysis project
AASHTO R 32-09 Calibrating the Load Cell and Deflection Sensors for FWDs	Ensures that FWD data used in pavement structural evaluation are accurate	Developed procedures and calibration centers in support of LTPP data collection
Equipment Startup Procedures for Resilient Modulus Testing Equipment	Ensures uniformity and accuracy of LTPP resilient modulus testing data for bound/unbound materials	Developed the procedures and processes
Distress Identification Manual for the Long-Term Pavement Performance Program	Helps to improve and/or standardize surface distress data collection	Developed the manual
Profile monitoring quality procedures and tools	Used to evaluate profiler equipment, compare performance of various models against actual measurements, and minor data	Developed procedures and tools

LOOKING FORWARD

Continued support of LTPP operations will provide a return on investment between 100:1 and 1000:1 for every dollar spent on pavements in the United States. In the report LTPP 2014 and Beyond[vii], FHWA has committed to supporting the following activities:

- Maintain the LTPP Information Management System (IMS)
- Continue Monitoring of Existing LTPP Test Sections
- Perform LTPP Data Analysis and Develop Products
- Improve and Enhance LTPP IMS Interface and Functionality
- Implement New LTPP Experiments
- Monitor Control HPMS Test Sections

This commitment is based on the availability of sufficient funding as part of future transportation funding legislation. **Continuing the LTPP program will yield information of tremendous value to pavement engineers, who will translate that information into strategies and procedures for building better, safer, and more cost-effective roads.**

More Information

More information on the LTPP program and how its products are being used to improve our highway system and ensure our highway dollars are well spent is available at http://www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/pavements/ltpp/.

Researchers – For information related to this document contact the LTPP Customer Support Service Center at tel: 202-493-3035 or email: ltppinfo@dot.gov.

Distribution – This document is being distributed according to a standard distribution. Direct distribution is being made to the Resource Centers and Divisions.

Availability – The document may be obtained from FHWA Product Distribution Center via e-mail report.center@dot.gov, tel: 814-239-1160, or fax 814-239-2156, or online at http://www.fhwa.dot.gov/research.

Key Words – Research, Long-Term Pavement Performance Program, Performance Measures.

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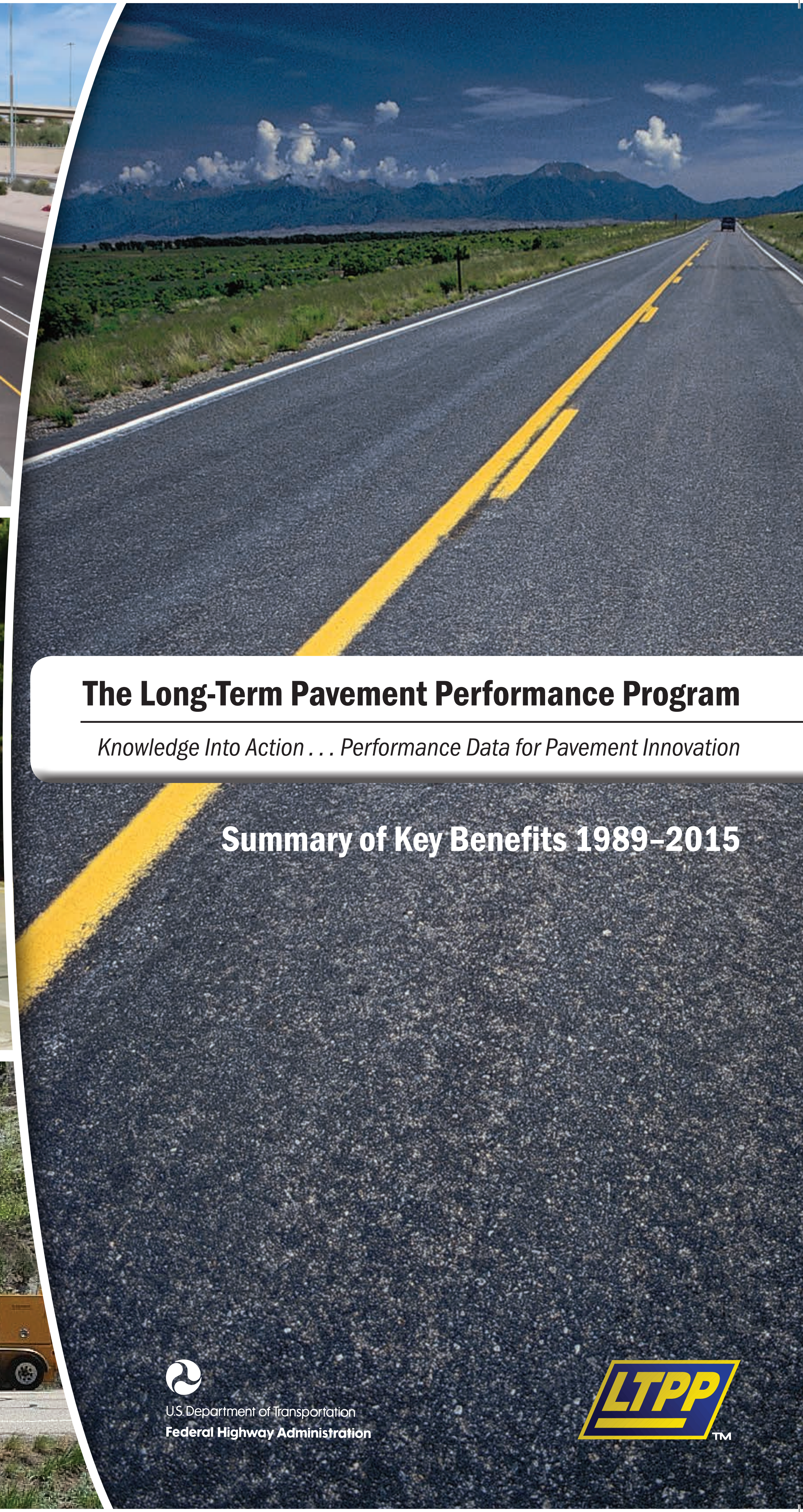


The Long-Term Pavement Performance Program

Knowledge Into Action . . . Performance Data for Pavement Innovation

Summary of Key Benefits 1989–2015

U.S. Department of Transportation
Federal Highway Administration

LTPP™

The Long-Term Pavement Performance Program

KNOWLEDGE INTO ACTION

Beginning in 1987, highway agencies and researchers have been monitoring, recording, and evaluating the performance of pavement sections on roadways in communities across the United States and Canada. Their mission: to learn why some pavements perform better than others so that future pavements can be designed and built to last longer. Their response: the Long-Term Pavement Performance program.

The Long-Term Pavement Performance Program

The Long-Term Pavement Performance (LTPP) program started in 1987 as part of the Strategic Highway Research Program (SHRP), a five-year applied research program funded by the 50 States. The LTPP program was established with a multidecade horizon, which would allow the test sections to be monitored until they reached the point of failure.

When SHRP ended in 1992, the Federal Highway Administration (FHWA) assumed responsibility for continuing the LTPP program. All 50 State highway agencies, as well as all Canadian Provinces, participate in the program.

To build durable, resilient pavements, the materials that go into the pavement mix and the type and thickness of the pavement layers must be carefully selected for the expected traffic and weather conditions. Building durable pavements demands knowledge of how different pavement materials and mixes respond to varying traffic volumes, traffic loads, and environments.

The LTPP program has been collecting this critical data by monitoring how in-service roadway pavements perform. The pavement sections are routinely monitored over their service life until they reach the point of failure. **What researchers learn about when and why they fail provides crucial information on how to build better, longer lasting, and more cost-effective roadways.**

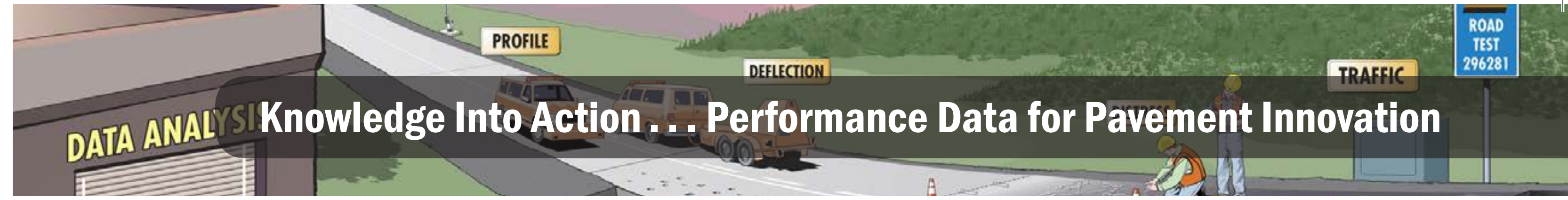
More than 2,500 in-service pavement sections at over 1,000 locations throughout the United States and Canada have served, and continue to serve, as the source of LTPP data. The test sections were carefully selected to represent an array of conditions and pavement types, and new experiments have been developed over the years to address evolving pavement design considerations.

The information gained from LTPP data helps researchers to understand which pavement designs perform better than others in specific circumstances, and why. Armed with that knowledge, pavement engineers can make well-founded decisions about pavement components, construction methods, and maintenance and repair strategies. **The result: State, county, and city governments can be confident that the pavements constructed in their communities will provide a smoother ride, with fewer delays, for many, many years.**

PERFORMANCE DATA FOR PAVEMENT INNOVATION – BENEFITS TO DATE

The LTPP program has already accumulated an estimated $2.5 billion in savings for highways.[i] Recognizing that, on average, taxpayers and departments of transportation spend over $150 billion per year on highway infrastructure, if observations and findings from this program help to increase the typical 20-year pavement design life by 1 year (or 5 percent), that is a savings of over $7 billion annually. Even if pavement design life is only increased by one month, that is still over $500 million in savings each year.

To help researchers and practitioners' access and make sense of the large amount of data collected and stored since 1987, the data have been made available through the program's Web-based portal, LTPP InfoPave™. More than 8,000 researchers from 120 countries have already accessed the LTPP database and are using the data for local and international studies and analyses.



Knowledge Into Action . . . Performance Data for Pavement Innovation

Highway agencies are not the only beneficiaries of the LTPP program. Families across the country will benefit, too. The Surface Transportation Policy Project estimates that family spending on transportation is at least five times greater than that spent by all levels of government; this translates to more than $220 billion per year from families' budgets. Even a savings of 1 percent generated by LTPP findings would yield tremendous benefits: a $2.2 billion reduction in costs to motorists.

By continuing to support LTPP program activities, highway agencies—and all roadway users—will benefit from annual returns that exceed the total investment in the program.

The LTPP data were used to calibrate the Mechanistic-Empirical Pavement Design Guide (MEPDG), adopted by the American Association of State Highway and Transportation Officials (AASHTO) in 2008 and incorporated into the AASHTOWare Pavement ME Design software, as one example of the practical use of this unique dataset.

The value and benefits of the LTPP program are also evident in the many new tools and procedures that have been developed as a result of the program. For instance, the regional falling weight deflectometer (FWD) calibration centers that were established for the LTPP program now serve a broader public purpose; highway agencies and private firms can bring their FWDs to the centers for calibration testing. Falling weight deflectometers, which are towed to a roadway and used to determine the structural properties of the pavement, are faster and less destructive than traditional test methods, which involve removing cores from the pavement. However, the FWDs must be periodically recalibrated to ensure they are accurately recording a pavement's response. The costs of an incorrectly calibrated FWD quickly add up; the Indiana Department of Transportation determined that an FWD that was only 1 mil (a thousandth of an inch) out of calibration resulted in additional construction and maintenance costs of $17,000 per mile.[ii]

The LTPP program also developed the Distress Identification Manual (DIM), which provides a standardized means of identifying and recording cracks, rutting, potholes, and other evidence of pavement distress. The DIM is now used by over half of the country's highway agencies, the Federal Highway Administration, and many local highway agencies.

Yet another product, the LTPPBind software package, allows highway agencies to select the proper grade of asphalt binder—the "glue" that holds an asphalt pavement together and gives it its resiliency—for a specific location. The binder selection process should consider the extreme high and low temperatures expected at a pavement site, and the temperature models developed under the LTPP program make that possible. Using the proper binder, as determined by LTPPBind, **saves highway agencies more than $50 million each year.**[iii]

The products mentioned here are just a small sample of the advances made as a result of the LTPP program. **Research conducted for the program has generated information, technologies, and practices that have improved the way we design and build modern-day pavements.** Every State and Provincial highway agency in the United States and Canada is a partner in the program, and all have benefited from the knowledge gained. The following table shows additional examples of products that are a result of the LTPP program.

Traffic on U.S. highways has changed dramatically over the past 50 years

In 1958, when the Nation's population was half what it is today, there were 68 million cars, trucks, and buses on the road. Since then, the number of vehicles has grown almost fourfold—to more than 253 million—while the total lane-miles of pavement has grown by less than 20 percent.[iv, v]

Take all that traffic and combine it with the age of our highway system, and it is no wonder that the Nation's highways and bridges are nearing the end of their service lives. As we continue to rebuild wornout pavements, how can we be sure that the new pavements will be able to withstand today's punishing traffic volumes and loads? How can we ensure that State and local governments, and the taxpayers who fund them, **get the best return on their investment in highway infrastructure**?

The answers to those questions are in the data being collected by the LTPP program.