RESEARCHNOTE

Long-Term Pavement Performance Program Updates on Accomplishments and Benefits

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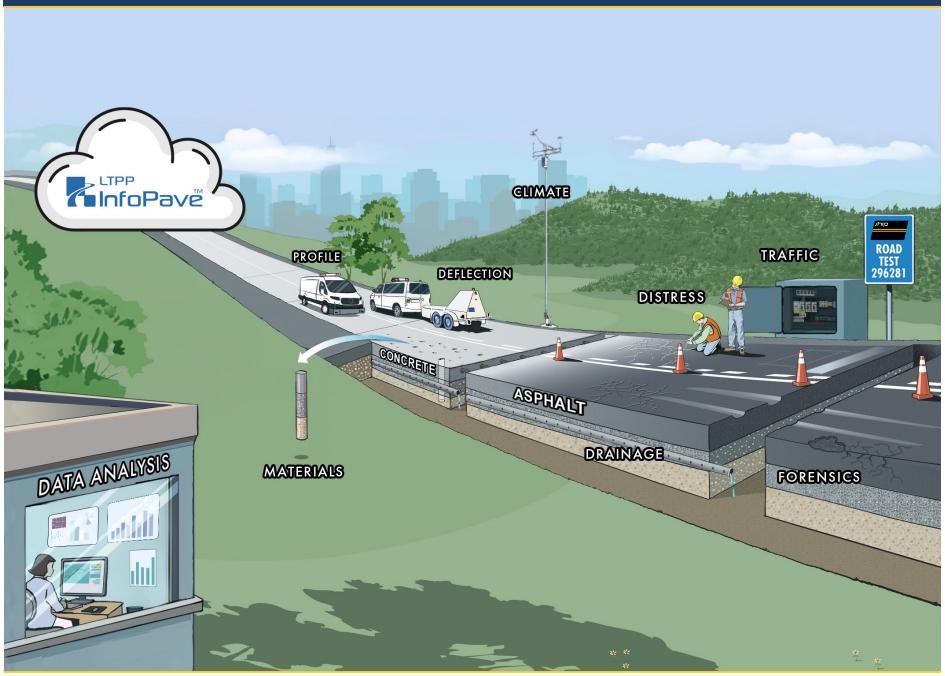
INTRODUCTION

Data collected by the Long-Term Pavement Performance (LTPP) program has been used to develop the world's most comprehensive source of in-service pavement performance information.(1) When established, the mission of the LTPP program was to collect and store performance data from a large number of in-service highways, analyze these data to describe and explain how pavements perform, and translate insights into knowledge and useful pavement engineering products.

Since 1989, over 2,500 pavement test sections across North America have been monitored by the LTPP program.(1) The resulting data have been used to establish a comprehensive national database to facilitate pavement research and understand how and why pavements perform as they do. This database has served as a resource to improve the safety, efficiency, and cost-effectiveness of the Nation's highway infrastructure. Figure 1 depicts the key data elements collected at the LTPP test sections and stored in the database.

Figure 1. Illustration. LTPP program data elements, data collection, storage, and analysis activities.



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LTPP DATA AT WORK

Data from LTPP test sections have been used to make significant contributions to the field of pavement engineering. The program has served as a data source for hundreds of national and State highway agency-led research studies and contributed to a wealth of literature, including research reports, technical papers, design products, and guidelines for day-to-day practices. Additionally, the LTPP program has produced a variety of products and procedures, such as the *Distress Identification Manual* (DIM), LTPPBind, and the LTPP Climate Tool.[2,3,4] One of the most significant uses of the LTPP data was the national calibration of the performance prediction models used in the AASHTOWare® Pavement Mechanistic-Empirical Design (PMED) software.[5] In addition, LTPP data have been used by State highway agency for local validation and calibration purposes. The data are available for dissemination via the LTPP InfoPave™ web portal.[6]

The LTPP program's impact has broadened since its inception. Following are a few highlights of some of the key contributions the LTPP program makes to help answer the questions of why and how pavements perform as they do:

- Develops national pavement data collection standards.
- Provides data and information that have been used in more than 6,000 LTPP-related publications between 2009 and 2025, becoming a trusted resource for pavement professionals.
- Turns data into products that have resulted in significant cost savings in billions of dollars for highway agencies.[7] Selected examples include: InfoPave™ web portal; DIM; LTPPBind software; falling weight deflectometer calibration and data collection procedures and centers; and weigh-in-motion installation, validation, and data quality protocols.[6,2,3]

BENEFITS AND COST-SAVINGS

Many aspects of the LTPP program that are clearly beneficial to the highway community are difficult to quantify monetarily. The Federal Highway Administration (FHWA) report *The Long-Term Pavement Performance Program—Accomplishments and Summary of Key Benefits 1989–2015* estimated that the program had contributed to the accumulation of an approximate $2.5 billion in savings for highways.[7] Estimated savings between 1989 and 2025 are likely around $6.8 billion, which equates to about $34,000 per lane mile of interstate (approximately 200,000 lane miles). For perspective, this amount of funding would be sufficient to pave every lane mile of road in New Hampshire with a little more than 1 inch of asphalt.

Other programs also benefit from the extensive experience and insight gained through the LTPP program. For example, plans for the Long-Term Bridge Performance Program emphasized lessons learned in LTPP: the importance of standardizing data collection procedures and documenting data cleaning and analysis in rigorous reports. In addition, university engineering curricula have also benefitted from the LTPP program through the introduction and use of LTPP data. Engineering schools with pavement engineering classes have developed course curricula around the LTPP data and database, examples include The Pennsylvania State University, Michigan State University, and the University of North Carolina.[8,9,10] Nearly 500 theses and dissertations have been produced using LTPP data in the United States and abroad.

While there have been significant returns on the investment in the program, many dividends are still to be gained in the years ahead. As the program advances into the future, its legacy and contributions to pavement engineering are likely to grow. With decades of data accumulation, technological advancements, and a growing global user base, the program is well-positioned to continue making significant contributions to transportation infrastructure and all pavement facets.

THE ROAD AHEAD

Performance data from the LTPP database can be used with accelerated pavement testing and advanced data analysis and modeling techniques, such as artificial intelligence, to develop performance models of new pavement materials and techniques. The vast amount of data that exist within the program allows for robust statistical analysis that compares performance characteristics based on real-world pavement conditions. This analysis is crucial when evaluating the performance of new materials that might not have extensive field data yet but have been tested in the laboratory. In addition, the LTPP Materials Reference Library will continue to be the location where pavement samples and materials are stored for future research projects, providing connections between old and new materials and lab techniques.[11] The LTPP data is the only data source for next-generation design procedures. States will continue to use the LTPP data to assist in local calibration of current and future pavement design procedures.

The LTPP program's pioneering role in pavement performance research has fundamentally shaped the understanding and management of highway infrastructure for almost four decades. As a result, the program has developed a proven framework for pavement research covering every aspect from experiment design to data analysis. The changing landscape of infrastructure, shifts in transportation demands, and economic pressures call for the LTPP program to remain flexible and responsive. As the program continues to evolve, embracing the opportunities presented by new technologies and working in close collaboration with our State and industry stakeholders, the LTPP program will be a cornerstone of innovation and progress in the transportation industry, helping to build and maintain safer, cost-efficient, and durable roadways for the next generation.

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