U.S. Department of Transportation
Federal Highway Administration

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LTPP Product List

The Federal Highway Administration's (FHWA) Long-Term Pavement Performance (LTPP) program is a 20-year study of inservice pavements designed to provide the data required to understand how and why pavements perform the way they do. The U.S. Congress mandated the LTPP program to "*prepare products and deliver them to the appropriate customers in a rational, organized manner.*" To fulfill this mandate, the LTPP program developed the products listed below.

NEW AND RECONSTRUCTED PAVEMENTS

Rigid Pavement Design (RPD) Software

The LTPP RPD software was developed to facilitate the application of the 1998 *Supplement to the Guide for Design of Pavement Structures*. The guidelines in this publication were developed based on studies conducted during National Cooperative Highway Research Program (NCHRP) Project No. 1-30. During this NCHRP project, researchers developed improved guidelines and performed field-verification tests using LTPP data to determine the practicality and appropriateness of applying the guidelines for concrete pavement design nationwide. The results of the NCHRP project represent a substantial improvement over the information provided in the 1993 version of the *Supplement to the Guide for Design of Pavement Structures*.

The RPD software automates the computations required to use the 1998 supplemental guidelines and includes separate tables for determining accumulated traffic loading, seasonally adjusted k-values, depth to rigid layer, and performing corner break and faulting checks. The magnitude of the cost savings from following the 1998 supplemental guidelines and using the software will vary with site conditions, with a 30 percent reduction being a reasonable average.

Coefficient of Thermal Expansion of Concrete

The potential for thermal expansion is an important consideration in the design of concrete pavements. Prior to the LTPP program, a standard test method did not exist for determining the coefficient of thermal expansion. Today, the American Association of State Highway and Transportation Officials (AASHTO) have adopted LTPP's test method as TP60-00, "Standard Test Method for Coefficient of Thermal Expansion of Hydraulic Cement Concrete." In addition, researchers use the test method at LTPP test sections.

LTPPBind 3.1

Based on an analysis of LTPP data and on the original binder selection software known as SHRPBind, LTPPBind is a Microsoft® Windows®-based program that can help highway agencies select the most suitable and cost-effective Superpave™ asphalt binder performance grade (PG) for a particular site. LTPPBind features a database of high and low air temperatures (minimum, mean, maximum, standard deviation, and number of years) for U.S. and Canadian weather stations, along with several modifications that provide users with the ability to (1) select PGs based on actual temperature conditions at their site and at the level of risk designated by their highway agency; (2) use either the original temperature models developed by the Strategic Highway Research Program (SHRP) or LTPP's revised temperature models for determining a site's binder PG; and (3) adjust PG selection for different levels of traffic loading and speed.

Guide for Determining Design Resilient Modulus Values for Unbound Materials

This guide is in CD-ROM format and contains three major components: an interactive tutorial, a technology transfer module, and supplemental materials. The interactive tutorial covers Resilient Modulus (M_R) startup and quality control test procedures for unbound materials. The technology transfer module contains overview presentations and videos that were developed in partnership with the Minnesota Department of Transportation (DOT). The supplemental materials section contains LTPP protocols, FHWA research reports, and many other supporting documents. The CD-ROM is designed for highway administrators, engineers, laboratory managers, and technicians to help them understand M_R and addresses key questions that they might have about the test procedures. Videos featured on the CD-ROM include:

- *Laboratory Resilient Modulus Testing: Is This the Right Time?* Intended for administrators and engineers, this 8-minute video explains M_R and its uses. The video also describes developments that have made M_R testing more consistent and easier to adopt.
- *Laboratory Resilient Modulus Testing: Startup and Quality Control Procedure.* This 15-minute video for laboratory managers and technicians begins with a detailed definition of M_R. It then explains the procedure developed under the LTPP program to ensure that a laboratory is arranged properly to conduct the M_R test procedure and collect accurate test results that are comparable regardless of where or when they were obtained.
- *Laboratory Resilient Modulus Testing: Sample Preparation and Test Procedure*. This 13-minute video for managers and technicians describes each step in the M_R test procedure, including how to prepare soil and aggregate samples.

Verification of Dynamic Test System—Emphasis on M_R

LTPP researchers have rewritten the startup procedure for M_R that was featured in the 1996 report *LTPP Materials Characterization Program: Resilient Modulus of Unbound Materials (LTPP Protocol P46) Laboratory Startup and Quality Control* (FHWA-RD-96-176). The new report *Long-Term Pavement Performance Materials Characterization Program: Verification of Dynamic Test Systems With an Emphasis on Resilient Modulus* (FHWA-RD-02-034) is more comprehensive and provides the background and theory behind the procedure. In addition, the standard practice extracted from the new report has been submitted informally to the AASHTO Subcommittee on Materials.

Test Method for Determining the Creep Compliance, M_R, and Strength of Asphalt Materials Using the Indirect Tensile Test Device

This LTPP program protocol describes three distinct procedures for determining the creep compliance, M_R, and strength of hot-mix asphalt concrete (HMA) using indirect tensile test techniques. The protocol is partially based on test standards AASHTO TP9-94 (Edition 1B), American Society for Testing and Materials (ASTM) standard D4123, and procedures outlined in section 4.4 of the protocol.

MAINTENANCE AND REHABILITATION

Pavement Maintenance and Repair Manuals

To provide highway managers and practitioners with the latest data on pavement maintenance and repair, researchers with the LTPP program revised and updated the original manuals generated from the SHRP H-106 maintenance experiment. The new manuals include additional pertinent long-term performance and cost-effectiveness information. The LTPP program generated this information through continued monitoring of the test sections. The following is a list of the updated manuals:

- *Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements* (FHWA-RD-99-168).
- *Materials and Procedures for Repair of Joint Seals in Portland Cement Concrete Pavements* (FHWA-RD-99-146).
- *Materials and Procedures for Rapid Repair of Partial-Depth Spalls in Concrete Pavements* (FHWA-RD-99-152).
- *Materials and Procedures for Repair of Potholes in Asphalt-Surfaced Pavements* (FHWA-RD-99-147).

PAVEMENT MANAGEMENT SYSTEMS

LTPP Distress Identification Manual

The LTPP program developed the *Distress Identification Manual for the Long-Term Pavement Performance Program* to provide a consistent, uniform basis for collecting distress data. The manual provides a common language for describing cracks, potholes, rutting, spalling, and other pavement distresses being monitored by the LTPP program. The manual is divided into three sections, each focusing on a particular type of pavement: (1) asphalt concrete (AC), (2) jointed portland cement concrete (PCC), and (3) continuously reinforced concrete pavement (CRCP). The manual includes photographs and text that clearly label, describe, and illustrate each type of distress. Many States have adopted the procedures established in the manual.

The LTPP program developed five versions of the manual:

- LTPP Distress Identification Manual (Standard Edition, FHWA-RD-03-031).
- AC Distress Identification Guide (Pocket Edition, FHWA-RC-05-001).
- PCC Distress Identification Guide (Pocket Edition, FHWA-RC-05-002).
- CRCP Distress Identification Guide (Pocket Edition, FHWA-RC-05-003).
- AC (for Local Agencies) Distress Identification Guide (Pocket Edition, LTAP-05-001).

Created with the field technician in mind, the pocket editions are made of durable plasticized material.

Guidelines for Temperature Adjustment of FWD Results for AC Pavements

Because the stiffness of AC varies with temperature, results from tests of flexible pavements using falling weight deflectometers (FWD) must be adjusted for temperature if the data were obtained at different times and are intended to be used interchangeably. Data analyses conducted by LTPP researchers have yielded procedures for temperature prediction and adjustment factors for asphalt pavements. Adopted by AASHTO and ASTM, these procedures and a related spreadsheet are intended for use in the analysis and interpretation of FWD test results.

ProVAL 2.6

FHWA developed the Pavement Profile Viewer and Analyzer (ProVAL) software to conduct the work described in the report *LTPP Profile Variability* (FHWA-RD-00-113). Based on the ProQual software created for the LTPP program, ProVAL enables the user to easily compare longitudinal profile data that has been obtained from multiple profile data collection runs on the same or different dates. ProVAL provides users with the analytic capabilities to compute summary indices, such as the International Roughness Index (IRI) and power spectral density (PSD), and includes several display functions. The intent is to provide pavement engineers with a tool that will help them understand what is really going on in the pavement, to support sound decisions regarding rehabilitation and repair, and to promote effective quality control of pavement profile data.

Pavement Smoothness Index Relationships (FHWA-RD-02-057)

This report illustrates the relationship between IRI and the profilograph using zero blanking band procedures based on LTPP profile data. The research effort behind this report led to the development of a series of relationships between the IRI and the Profile Index that can help States transition to IRI or the "zero blanking" band smoothness specification for HMA and portland cement concrete pavements.

TRAFFIC LOADING AND ENVIRONMENTAL EFFECTS

LTPP Seasonal Monitoring Program (SMP) CD-ROM

The LTPP SMP was an intensive monitoring effort undertaken on a subset of the LTPP test sections to obtain data that will improve our understanding of seasonal variations in pavement structures and the factors that cause those variations. The SMP CD-ROM set includes three disks that summarize the project and provide all of the information and supporting documentation needed to facilitate future application of the LTPP data. The CD-ROM includes two videos produced by the North Carolina and Colorado DOTs. The videos document the installation of the instrumentation of the LTPP SMP test sections in both States.

Standard Specification for Smoothness of Pavement at the Approaches to Weigh-in-Motion (WIM) Scales, AASHTO Designation MP 14-05

The smoothness of the pavement surface at the approach to and departure from a WIM scale directly affects the scale's ability to accurately estimate static loads from measured dynamic forces. Lack of smoothness creates difficulties in calibrating WIM equipment and may cause poor results from subsequent efforts to collect vehicle weight data. To assist State and local agencies in their data collection efforts, the LTPP program, in conjunction with AASHTO, has promulgated specification MP 14-05. The specification requires field collection of profile information at a candidate WIM site and then uses specific software to calculate indices of long- and short-range pavement roughness. The specification includes a range of acceptable levels that provide a 95-percent level of confidence that the WIM approach roughness will not produce errors that exceed requirements. This helps ensure that calibration and validation of the site will be obtainable. This project is critical for the traffic data collection efforts that will feed directly into the new *Guide for the Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures*.

NATIONAL PAVEMENT PERFORMANCE DATA SERVICES

DataPave Online

DataPave Online is a user-friendly Web application that provides access to the data contained in the LTPP Standard Data Release. These data include inventory, materials testing, pavement performance monitoring, climatic, traffic, maintenance, rehabilitation, and seasonal testing data from more than 2,500 pavement test sections throughout North America.

LTPP Standard Data Release

The Long-Term Pavement Performance (LTPP) program makes the world's largest pavement performance database available annually to the public in Microsoft Access format and available as a 5 CD set or on a single DVD.

ADDITIONAL INFORMATION

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