Long-Term Pavement Performance Program

The Long Term Pavement Performance Program

North Central Asphalt User/Producer Group

Jan 28, 2004 Omaha NE
LTPP Development

1984 ➢ Strategic Transportation Research Study

1985-1987 ➢ LTPP Planning

1987-1992 ➢ Strategic Highway Research Program
   (LTPP: $50 Million component of SHRP)

1992 - 2009 ➢ FHWA – LTPP Data Collection and Data Analysis
WHAT IS LTPP & IT’s OBJECTIVE?

- Monitor Sites across the North American Continent --> Research DATABASE
- Understanding “why” some pavements perform better than others: Lead to Better Performing and More Cost Effective Pavements.
General Pavement Studies (GPS)

GPS-1 → Asphalt Concrete (AC) on Granular Base
GPS-2 → AC on Bound Base
GPS-3 → Jointed Plain Concrete Pavement
GPS-4 → Jointed Reinforced Concrete Pavement
GPS-5 → Continuously Reinforced Concrete Pavement
GPS-6A → Existing AC Overlay on AC Pavements
GPS-6B → New AC Overlay on AC Pavements
GPS-7A → Existing AC Overlay on Portland Cement Concrete (PCC) Pavements
GPS-7B → New AC Overlay on PCC Pavements
GPS-9 → Unbounded PCC Overlays on PCC Pavements
General Pavement Studies (GPS)

- Focus on most commonly used pavement designs
- Experimental design: full factorial
- One 500 foot section per location

**Primary Factors**
- Subgrade: fine & course
- Traffic: medium & heavy
- Temp: freeze and non-freeze
- Moistures: wet and dry

**Secondary Factors**
- AC thickness
- AC stiffness
- SN of base and subgrade
- PCC thickness
- Joint spacing
Approximately 800 sections
Specific Pavement Studies (SPS)

SPS-1 → Strategic Study of Structural Factors for Flexible Pavements
SPS-2 → Strategic Study of Structural Factors for Rigid Pavements

SPS-3 → Preventative Maintenance Effective for Flexible Pavements
SPS-4 → Preventative Maintenance Effective for Rigid Pavements

SPS-5 → Rehabilitation of AC Pavements
SPS-6 → Rehabilitation of Jointed PCC Pavements
SPS-7 → Bonded PCC Overlays on Concrete Pavements

SPS-8 → Study of Environmental Effects in the Absence of Heavy Loads

SPS-9 → Validation of SHRP Asphalt Specification and Mix Design (Superpave)
Specific Pavement Studies (SPS)

• Focus on certain pavement engineering factors
• Experimental design: half factorial
• Multiple 500 feet sections per location

**Primary Factors**

Subgrade: fine & course  
Traffic: medium & heavy  
Temp: freeze and non-freeze  
Moistures: wet and dry

**Secondary Factors**

AC drainage - yes, no  
AC thickness  
AC base type and thickness  
PCCP drainage- yes, no  
PCC strength and thickness  
Lane width  
Base type
Specific Pavement Studies (SPS)

Approximately 1,600 Sections
LTPP’s GOAL

To provide answers to **HOW** and **WHY** pavements perform as they do!
11.

LTPP’s CORE FUNCTIONS

1. Data Collection and Management

- Collect, Process, Store and Provide Readily Accessible, Quality Data
LTPP Data Collection

LTPP Data & Information

- Climate
- Load
- Structure
- Distress

Materials

Response
FWD Data Collection
Profile Data Collection
Distress Data Collection
Materials Sampling
Materials Test Data Collection

• AC Layer - thickness and properties
  – Resilient Modulus
  – Specific Gravity
  – Asphalt Content

• PCC Layer - thickness and properties
  – Compressive and Splitting Tensile Strength
  – Coefficient of Thermal Expansion
  – Static Elastic Modulus

• Unbound Layers - thickness & properties
  – Resilient Modulus
  – Classification and Sieve Analysis
  – Moisture/Density Relations
Materials Properties Testing
Weather Station Data
Seasonal Variation Data Collection
Forensic/Diagnostic Investigations
Traffic Data - WIM & AVC

- Vehicle Weight Data and Vehicle Classification
LTPP Data & Information:

- Pavement Performance Database
- Central Traffic Database
- Ancillary Data
LTPP Database

MODULES (12 Modules)
- Climatic
- General
- Inventory
- Maintenance
- Monitoring
- Rehabilitation
- SMP
- SPS (10)
- Traffic
- etc

TABLES (516 Tables)
- Deflection
- Profile
- Friction
- Distress
- Materials
- etc

ELEMENTS (12,844 elements)
- Date
- Time
- Temperature
- Properties
- Individual data elements

- > 30 gigabytes of data in the Database
- > 40 gigabytes of data off-line
LTPP Pavement Performance Database: Release History

- Release 1, January 1991 ⇔ < 300 records
- Release 2, July 1991 ⇔ ~ 2K records
- Release 3, January 1992 ⇔ ~ 8K records
- Release 14, July 2002 ⇔ ~ 125M records
- Release 17, January 2004 ⇔ ~ 135M records
Some Database Statistics
(August 2003)

- > 7,000,000 FWD readings
- > 100,000 Longitudinal profile runs
- > 20,000 Distress surveys
- > 70,000 Material tests
- > 6,000 Data exports (7.5 GB)
- > 45,000 Modulus test points
LTPP’s CORE FUNCTIONS

1. Data Collection and Management

2. Data Analysis
   — > Understand Pavement Performance
Purpose of Data Analysis

- Quantify how pavements perform
- Understand why they perform as they do
- Validate and calibrate existing procedures
- Develop new procedures
- Provide quality control of data
Types of Data Analysis Done

- Studies of variability in traffic, materials and performance data
- Development of improved design procedures
- Comparison of pavement performance
- Field validation of pavement design procedures
- ASCE-LTPP data analysis contest
Strategic Analysis Plan Objectives

**Traffic** characterization and prediction

**Materials** characterization

Determination of **environmental effects** in pavement design and performance prediction

Evaluation and use of **pavement condition data** in pavement management

Development of pavement response and **performance models** applicable to pavement design and performance prediction

Maintenance and rehabilitation **strategy selection** and performance prediction

Quantification of the performance impact of specific **design features**
Customer Requests: 1997 - 2003

Requests by Organization

Total Requests = 2, 911
LTTPP’s CORE FUNCTIONS

1. Data Collection and Management
2. Data Analysis
3. Communication
   → Ensure Access to LTTPP Program Information
Communication Tools

- Meetings
- Workshops/Contests
- Publications
  - Brochures
  - TechBriefs
  - Product Briefs
- Research Reports
- Products
- Videos

• Website
LTPP’s CORE FUNCTIONS

1. Data Collection and Management
2. Data Analysis
3. Communications

4. Product Development
   → Develop and Deliver Usable Tools
LTPP Products

Some Products …

- LTPPBind
- Resilient Modulus CDROM
- FWD Calibration Procedures
- Manuals of Practice
- SMP CDROM
- Guidelines for FWD Temperature Adjustments
- Rigid Pavement Design Software
- ProVal
- DataPave online
Access to the Data

The Long-Term Pavement Performance (LTTP) program, the largest pavement study ever conducted, is becoming the primary source of pavement performance information for the North American highway community. This 30-year LTTP program was initiated in 1967 as part of the Strategic Highway Research Program (SHRP). Responsibility for program management was transferred to FHWA in 1992. Today, the program has more than 2,400 test sections on in-service highways at over 900 locations throughout North America. Data are collected through cooperative efforts of the agencies that own the pavement and the LTTP program organization. The extensive data collection effort includes inventory, material testing, pavement performance monitoring, climate, traffic, maintenance, rehabilitation, and seasonal testing modules. The data are housed in an information management system (IMS) - the LTTP database - that is the world's largest pavement performance database, with enormous potential for the development of products to improve pavement technology. The data are subject to an extensive series of quality control checks before being made available to the public.

LTTP DataPave Online is a major effort to make the LTTP data more accessible to worldwide transportation community. LTTP DataPave Online has been developed to address two objectives:

**Visualisation** - The first objective is to provide mid- and upper-level managers and other users with quick, easy-to-use presentations to illustrate the value and potential of LTTP data.

**Analysis** - The second objective is to provide a user-friendly format for exploring, extracting, and organizing the extensive LTTP data for data analysis.

LTTP DataPave Online has been developed by ENGINEERING Corporation. Please visit the FHWA LTTP Web Site for more information on the LTTP program and database.

DISCLAIMER: This web site is an evaluation site for the database application program “DataPave” produced by the Long Term Pavement Performance (LTTP) program. The Federal Highway Administration (FHWA)/LTTP updates the database information on the web site every six months. For more up to date information, please visit the FHWA LTTP Web Site.
Closing Comments:

- LTPP & New Pavement Design Guide
- Where to go to get more LTPP Info.
LTPP’s Role in the New Design Guide

- Validation and Calibration
- Material Characterization
  - LTPP soil Mr test procedure
  - Source of typical values
- Environmental Effects
  - Source of climatic data
- Evaluation of Existing Pavements
  - LTPP’s backcalculation procedure
  - FWD calibration procedures
Welcome to LTPP

Understanding "why" some pavements perform better than others is key to building and maintaining a cost-effective highway system. That's why in 1987, the Long-Term Pavement Performance (LTPP) program — a comprehensive 20-year study of in-service pavements — began a series of rigorous long-term field experiments monitoring more than 2,400 asphalt and portland cement concrete pavement test sections across the U.S. and Canada.

Established as part of the Strategic Highway Research Program (SHRP) and now managed by the Federal Highway Administration (FHWA), LTPP was designed as a partnership with the States and Provinces. LTPP's goal is to help the States...
Some LTPP Websites:

FHWA-LTPP Homepage:
- www.tfhrc.gov/pavement/ltpp/ltpp.htm

LTPP Technical Support Services
- www.ltpp.org

DATAPAVE on line:
- www.datapave.com

LTPP - North Central Regional Office (NCRO)
- www.stantec.com/ltpp/ncro

Email: LTPPINFO@fhwa.dot.gov
THANK YOU

Hardcopies:

• LTPP Data Analysis Plan
• LTPP Website Addresses