

Long-Term Pavement Performance Data Analysis Program

Strategic Plan Objectives, Analysis Outcomes, and Supporting Projects

<http://www.fhwa.dot.gov/pavement/ltp/stratplan/strategic.cfm>



Strategic Objective 1:	Strategic Objective 2:	Strategic Objective 3:	Strategic Objective 4:	Strategic Objective 5:	Strategic Objective 6:	Strategic Objective 7:
<p>Traffic characterization and prediction</p> <p>A. Guidelines for data collection (Hardware, software, placement, calibration, data collection frequency). Some elements require work beyond LTPP data analysis, but analysis is needed to provide some components.</p> <p>NCHRP 1-39 \$500,000 Traffic Data Collection, Analysis, and Forecasting for Mechanistic Pavement Design. Project completed Aug. 30, 2000 Reports 509 and 538 July 30, 2004 Cambridge Systematics/Went/Hanna</p> <p>FHWA \$450,000 Evaluation of WIM Site Data and Tools for Determining Load Data Confidence. Project completed Feb. 1, 2001 Reports 509 and 538 July 30, 2004 Cambridge Systematics/Went/Hanna</p> <p>B. Guidelines for applying traffic loading and classification data in pavement design.</p> <p>FHWA \$267,810 Optimization of Traffic Data Collection for Specific Pavement Applications. Project completed Jan. 23, 2003 FHWA-RD-03-079 Aug. 15, 2003 Nicholas/Pastor/Williams (Coordinated with NCHRP 1-39)</p> <p>C. Procedures for forecasting and back-casting traffic loading data.</p> <p>FHWA \$250,000 Estimating Cumulative Traffic Loads, Phase 1. Project completed Oct. 15, 1998 FHWA-RD-00-054 Sept. 30, 2001 ERES/Hajj/Wisner</p> <p>FHWA \$233,000 Estimating Cumulative Traffic Loads, Phase 2. Project completed Oct. 31, 1999 FHWA-RD-03-094 Dec. 20, 2002 ERES/Hajj/Wisner</p> <p>FHWA \$171,000 Procedures for Forecasting and Back-Casting Traffic Loading Data. (To be revised by the Traffic ETG). Project completed Oct. 31, 1999 FHWA-RD-03-094 Dec. 20, 2002 ERES/Hajj/Wisner</p> <p>D. Impact of pavement roughness on the dynamic loads applied to pavements.</p> <p>FHWA \$228,075 Review of the LTPP Backcalculation Results. Project completed Jan. 23, 2003 FHWA-HRT-05-150 June 1, 2005 ERES/Stubstad/Wisner</p> <p>FHWA LTPP WIM Approach Smoothness Specifications. Project completed Nov. 2005 ASHTO MP-14 UMR/Wisner</p>	<p>Materials characterization</p> <p>A. Relative importance of different material characteristics in predicting pavement performance.</p> <p>NCHRP 20-50(14) \$100,000 Significance of As-Constructed AC Air Voids in Pavement Performance. Project completed June 5, 2000 Research report 269 June 28, 2002 Applied Pav Tech. Seeds/Hanna</p> <p>FHWA \$243,000 Evaluation of Selected LTPP Material Data Tables and Development of Representative Test Tables - Volume 1. Project completed Sept. 1, 1999 FHWA-RD-02-001 Mar. 1, 2001 ERES/Hajj/Wisner</p> <p>FHWA \$227,000 Study of LTPP Laboratory Resilient Modulus Test Data and Response Characteristics. Project completed Apr. 30, 2001 FHWA-RD-02-051 Apr. 30, 2001 ERES/Fugro-BRE Von Quintus/Richter</p> <p>B. Relationships to enable interchangeable use of laboratory and field-derived material parameters.</p> <p>FHWA \$231,000 Temperature Predictions and Adjustments Factors for Asphalt Pavements. Project completed Oct. 1, 1994 FHWA-RD-98-085 June 1, 1999 Braun/Lukman/Richter</p> <p>FHWA \$270,000 Analysis Relating to Pavement Material Characteristics and Their Effects on Pavement Performance. Project completed Sept. 1, 1997 Fugro-BRE Von Quintus/Richter</p> <p>FHWA \$125,000 Backcalculation of Layer Parameters for LTPP Test Sections, Volume 1. Project completed July 7, 1997 FHWA-RD-00-066 Aug. 31, 1998 ERES/Khanzouz/Richter</p> <p>FHWA \$171,000 Backcalculation of Layer Parameters for LTPP Test Sections, Volume 2. Project completed May 1, 1997 FHWA-RD-01-113 Aug. 31, 2001 Fugro-BRE Von Quintus/Richter</p> <p>FHWA \$228,075 Review of the LTPP Backcalculation Results. Project completed Jan. 23, 2003 FHWA-HRT-05-150 June 1, 2005 ERES/Stubstad/Wisner</p> <p>C. Relationship between as-designed and as-built material characteristics.</p> <p>FHWA \$400,000 Evaluation of Key Hot Mix Asphalt Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p> <p>FHWA \$267,810 Estimation of Key PCC Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p> <p>D. Performance impact of different levels of material variability and quality.</p> <p>FHWA \$200,000 Estimation of Key PCC Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p> <p>E. Estimate material design parameters from other material data (for example, Resilient Modulus from gradation and density).</p> <p>FHWA \$200,000 Estimation of Key PCC Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p> <p>F. Improved deflection-based analysis methods for materials characterization.</p> <p>FHWA \$200,000 Estimation of Key PCC Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p> <p>G. Combination of all results under the objective to provide a unified set of tools/guidelines for characterizing pavement materials/soils for pavement design and construction.</p> <p>FHWA \$200,000 Estimation of Key PCC Base, Subbase, and Component Engineering Properties from Routine Tests and Physical Characteristics. Project completed Jan. 2000 FHWA-RD-03-092 Oct. 2000 Mohsen/Mohsen/Symons</p>	<p>Determination of environmental effects in pavement design and performance prediction.</p> <p>A. Impact of temperature and moisture variations (independent of frost penetration) on pavement performance.</p> <p>NCHRP 9-23 \$487,234 Environmental Effects in Pavement Mix and Structural Design Systems. Project completed Feb. 27, 2001 Web document 60 Aug. 31, 2003 Arizona State U. Houston/Hanna</p> <p>NCHRP 20-50(712) \$349,969 Daily and Seasonal Variations in In-Situ Material Properties. Project completed Feb. 7, 2000 Web document 60 Aug. 31, 2003 U. of Tennessee Durum/Hanna</p> <p>FHWA \$94,000 Study of LTPP Pavement Temperatures. Project completed Oct. 1999 FHWA-RD-02-071 Nov. 1999 Brown/Consultant/Lukman/Symons</p> <p>FHWA \$103,056 Analysis of Time Domain Reflectometry Data. Project completed Aug. 1997 FHWA-RD-98-115 July 1998 ERES/Jiang/Richter</p> <p>FHWA \$0 Seasonal Variations in the Moduli of Unbound Pavement Layers. Project completed May 1, 1997 FHWA-RD-04-079 Mar. 31, 2001 FHWA Staff Richter</p> <p>FHWA \$200,000 Evaluation of LTPP Site-Specific Climate Data. Project completed July 1, 2004 N/A Dec. 31, 2006 FHWA Staff Richter</p> <p>NCHRP 1-40 \$50,000 Facilitating the Implementation of the Guide for the Design of New and Rehabilitated Pavement Structures. Project completed July 1, 2004 N/A Dec. 31, 2006 FHWA Staff Richter</p> <p>FHWA \$270,000 Analysis Relating to Pavement Material Characteristics and Their Effects on Pavement Performance. Project completed Sept. 1, 1997 Fugro-BRE Von Quintus/Richter</p> <p>FHWA \$125,000 Backcalculation of Layer Parameters for LTPP Test Sections, Volume 1. Project completed July 7, 1997 FHWA-RD-00-066 Aug. 31, 1998 ERES/Khanzouz/Richter</p> <p>FHWA \$171,000 Backcalculation of Layer Parameters for LTPP Test Sections, Volume 2. Project completed May 1, 1997 FHWA-RD-01-113 Aug. 31, 2001 Fugro-BRE Von Quintus/Richter</p> <p>FHWA \$228,075 Review of the LTPP Backcalculation Results. Project completed Jan. 23, 2003 FHWA-HRT-05-150 June 1, 2005 ERES/Stubstad/Wisner</p> <p>C. Long-term changes in pavement characteristics due to environmental effects and aging.</p> <p>FHWA \$86,022 Determination of Frost Penetration in LTPP Sections. Project completed Aug. 1997 FHWA-RD-99-088 Aug. 31, 2001 ERES/Jiang/Richter</p> <p>FHWA \$375,000 Effect of Multiple Freeze Cycles and Deep Frost Penetration on Pavement Performance and Cost. Project completed Mar. 4, 2003 FHWA-HRT-06-121 June 1, 2006 Nichols/Jackson/Wisner</p> <p>D. Recommendations for climate data collection to reduce pavement performance prediction.</p> <p>FHWA \$135,000 Verification of LTPP Virtual Weather Stations - Phase I: Accuracy and Reliability of Virtual Weather Stations. Project completed June 1, 1996 FHWA-RD-97-103 Nov. 1996 ERES/Mohsen/Mohsen/Symons</p> <p>FHWA \$135,000 Verification of LTPP Virtual Weather Stations - Phase II: Accuracy and Reliability of Virtual Weather Stations. Project completed June 1, 1996 FHWA-RD-97-103 Nov. 1996 ERES/Mohsen/Mohsen/Symons</p>	<p>Evaluation and use of pavement condition data in pavement management.</p> <p>A. Comprehensive guidelines for assessing the relative performance of different pavements.</p> <p>NCHRP 1-35A \$200,000 Guide for Pavement Management. Project completed June 30, 1997 ASHTO Pavement Management Guide Texas A&M U. Smith/Hanna</p> <p>FHWA \$100,000 Analysis of LTPP Friction Data. Project completed Aug. 1, 1997 FHWA-RD-99-037 Dec. 31, 2000 ERES/Glover/Richter</p> <p>FHWA \$141,000 Pavement Data Consolidation. Project completed Aug. 15, 1998 FHWA-RD-01-143 Mar. 1, 2000 Fugro-BRE Simpson/Richter</p> <p>FHWA \$58,000 Preliminary Evaluation and Analysis of LTPP Friction Data. Project completed May 1, 1998 FHWA-RD-00-076 Mar. 1, 1998 ERES/Tarshcher</p> <p>FHWA \$190,000 Characterization of Transverse Profile Data. Project completed July 28, 1997 FHWA-RD-01-024 Mar. 1, 2000 Fugro-BRE Simpson/Richter</p> <p>FHWA \$80,000 Smoothness Index Relationships. Project completed Feb. 1, 2001 FHWA-RD-02-057 Nov. 1, 2001 ERES/Smith/Swanson</p> <p>FHWA \$74,991 Statistics Index Differences Related to LTPP Equipment Type. Project completed Jan. 6, 2004 FHWA-RD-05-054 Aug. 31, 2005 CTL/Peraera/Wisner</p> <p>B. Improve measures of pavement structural condition for use in network-level pavement management.</p> <p>FHWA \$100,000 Study of LTPP Pavement Deflections. Project completed Sept. 2001 FHWA-RD-03-093 Sept. 2001 Consultat Substad/Symons</p> <p>FHWA \$100,000 Characterization of PCC Pavement Curves. Project completed Sept. 2001 FHWA-RD-03-093 Sept. 2001 Consultat Substad/Symons</p> <p>FHWA \$100,000 Characterization of PCC Pavement Curves. Project completed Sept. 2001 FHWA-RD-03-093 Sept. 2001 Consultat Substad/Symons</p> <p>FHWA \$100,000 Characterization of PCC Pavement Curves. Project completed Sept. 2001 FHWA-RD-03-093 Sept. 2001 Consultat Substad/Symons</p> <p>FHWA \$100,000 Characterization of PCC Pavement Curves. Project completed Sept. 2001 FHWA-RD-03-093 Sept. 2001 Consultat Substad/Symons</p>	<p>Development of pavement response and performance models applicable to pavement design and performance prediction.</p> <p>A. Guidelines for selection of appropriate load-response models for use in pavement design as a function of the acceptable level of risk and model complexity.</p> <p>NCHRP 1-37A \$6,579,800 Development of the 2002 Guide for the Design of New and Rehabilitated Pavement Structures (Phase II). Project completed Feb. 1, 1998 Web document 47 Mar. 31, 2002 Kathleen Hall/Hanna</p> <p>FHWA \$80,000 Comparison and Quality Evaluation of LTPP Dynamic Load Response Data from Ohio and North Carolina. Project completed Dec. 1999 Report pending Dec. 2000 FHWA Staff Staff/Weaver</p> <p>B. Mechanistic-empirical procedures for using commonly collected pavement data to predict specific distress types.</p> <p>NCHRP 20-50(5) \$249,991 Variations in Pavement Design Inputs. Project completed July 13, 1999 Web document 48 Oct. 12, 2001 Consultat Substad/Hanna</p> <p>FHWA \$400,000 Evaluation of the Performance Prediction Models in the 2002 Pavement Design Guide. Project completed July 1, 1999 FHWA-RD-98-198 Oct. 1, 1999 ERES/Hajj/Richter</p> <p>FHWA \$84,000 Design and Construction of PCC Pavements, Volume I. Project completed Oct. 1, 1994 FHWA-RD-98-127 Aug. 1, 1998 ERES/Glover/Richter</p> <p>FHWA \$84,000 Design and Construction of PCC Pavements, Volume II. Project completed Oct. 1, 1994 FHWA-RD-98-113 Aug. 1, 1998 ERES/Glover/Richter</p> <p>NCHRP 1-41 \$500,000 Models for Predicting Reflection Cracking of Hot-Mix Asphalt Overlays. Project completed Feb. 2008 Texas A&M U. Went/Hanna</p> <p>FHWA \$84,000 Design and Construction of PCC Pavements, Volume III. Project completed Oct. 1, 1994 FHWA-RD-98-113 Aug. 1, 1998 ERES/Glover/Richter</p> <p>NCHRP 1-42 \$93,556 Top-Down Fatigue Cracking of Hot-Mix Asphalt Layers - Phase I. Project completed Aug. 22, 2003 July, Asphalt Tech. Christians/N/A</p> <p>FHWA \$240,003 Common Characteristics of Good and Poorly Performing PCC Pavements. Project completed Oct. 1, 1996 FHWA-RD-97-131 Nov. 1, 1997 ERES/Khanzouz/Richter</p> <p>FHWA \$240,003 Common Characteristics of Good and Poorly Performing AC Pavements. Project completed Oct. 1, 1996 FHWA-RD-97-131 Nov. 1, 1997 ERES/Khanzouz/Richter</p>	<p>Maintenance and rehabilitation strategy selection and performance prediction.</p> <p>A. Performance and efficacy of maintenance and rehabilitation treatments as a function of pre-treatment condition.</p> <p>NCHRP 20-50(34) \$250,000 Effectiveness of Maintenance and Rehabilitation Operations. Project completed Oct. 14, 1999 Web document 47 Mar. 31, 2002 Kathleen Hall/Hanna</p> <p>FHWA \$54,000 Performance of Rehabilitated AC Pavements in the LTPP Experiments. Project completed Oct. 1, 1997 FHWA-RD-00-029 Aug. 1, 1999 Fugro-BRE Richter</p> <p>FHWA \$25,433 Assessment of the SPB-7 Bonded Concrete Overlay Experiments. Project completed July 1, 1999 FHWA-RD-98-130 Dec. 1, 2000 ERES/Smith/Richter</p> <p>FHWA \$54,000 LTPP Maintenance and Rehabilitation Data Review. Project completed July 1999 FHWA-RD-01-019 Von Quintus/Richter</p> <p>B. Guidelines for timing and selection of pavement maintenance and rehabilitation operations, and expected performance impacts of each.</p> <p>NCHRP 1-38 \$100,000 Guide on Pavement Rehabilitation Strategies. Project completed Mar. 1, 1999 Web document 35 Mar. 31, 2001 Kathleen Hall/Hanna</p> <p>NCHRP 14-14 \$312,397 Guide for Optimal Timing of Pavement Preventive Maintenance Treatment Applications. Project completed Apr. 10, 2000 Report 523 Sept. 30, 2003 Applied Pav Tech. Christians/Hanna</p> <p>FHWA \$80,000 Guidelines for Selecting Pavement Rehabilitation Strategies That Consider Impact on Pavement Life and/or Performance (after 20-50(34)). Project completed Oct. 2001 FHWA-RD-03-093 Oct. 2001 Data Study TBD</p>	<p>Quantification of the performance impact of specific design features (presence or absence of positive drainage, differing levels of pre-ribs surface preparations, etc.).</p> <p>NCHRP 20-50(2) \$74,963 Relative Performance of Jointed Plain Concrete Pavements with Sealed and Unsealed Joints. Project completed July 29, 1999 Web document 32 Jan. 31, 2001 Kathleen Hall/Hanna</p> <p>FHWA \$380,000 Review of SPS-1, -2, -5, and -6 Experiments. Project completed Dec. 31, 2000 FHWA-RD-01-166 to 169 Mar. 1, 2000 Darler & ERES/Fugro-BRE Von Quintus/Richter</p> <p>FHWA \$191,000 Evaluation and Analysis of LTPP Pavement Layer Thickness Data. Project completed Sept. 1, 1999 FHWA-RD-03-041 Dec. 31, 2000 Jiang/Richter</p> <p>FHWA \$75,000 Study of Environmental Effects in the Absence of Heavy Loads-SPS-8 - Initial Evaluation of Analysis. Project completed Mar. 2001 FHWA-RD-02-087 Mar. 2002 ERES/Madewell/Richter</p> <p>FHWA \$75,000 Evaluation of Joint and Crack Load Transfer. Project completed Mar. 2001 FHWA-RD-02-088 Mar. 2002 ERES/Khanzouz/Richter</p> <p>NCHRP 20-50(1016) \$299,301 Pavement Design and Construction Features on the Response and Performance of New Flexible and Rigid Pavements. Project completed June 27, 2002 Web document 74 Mar. 22, 2005 Mohsen/Hanna</p> <p>FHWA \$75,000 Impact of Design Features on Pavement Response and Performance in Predictable and Rigid Pavements. Project completed Mar. 2001 FHWA-RD-03-041 Dec. 31, 2000 Data Study TBD</p> <p>B. Impact of design features on pavement distress.</p> <p>NCHRP 1-34A \$149,823 Contributions of Pavement Structure Layers to Routing of Flexible Pavements. Project completed July 31, 2001 Report 468 July 31, 2001 Purdue RF White-Haddock/Hanna</p> <p>NCHRP 1-34B \$50,000 Effectiveness of Subsurface Drainage for Hot and PCC Pavements. Project completed Apr. 1, 1999 Research report 268 Nov. 30, 1999 Kathleen Hall/Hanna</p> <p>NCHRP 1-34C \$116,524 Effects of Subsurface Drainage on Performance of Asphalt and Concrete Pavements. Project completed Apr. 6, 2000 Report 499 Mar. 31, 2003 Kathleen Hall/Hanna</p> <p>NCHRP 1-34D \$230,000 Effects of Subsurface Drainage on Performance of Asphalt and Concrete Pavements. Evaluation and Analysis of LTPP SPS-1 and SPS-2 Field Sections. Project completed Nov. 18, 2002 Report 583 Dec. 31, 2006 Kathleen Hall/Hanna</p> <p>NCHRP 20-50(813) \$159,998 Factors Affecting Pavement Smoothness. Project completed Oct. 25, 1999 Web document 40 Dec. 30, 2001 Soil & Mattl Eng'rs. Kohn/Hanna</p> <p>FHWA \$194,534 Investigation of Development of Pavement Roughness. Project completed June 1, 1995 FHWA-RD-97-147 Aug. 1, 1997 Soil & Materials Eng'rs. Peraera/Richter</p> <p>FHWA \$240,003 Common Characteristics of Good and Poorly Performing PCC Pavements. Project completed Oct. 1, 1996 FHWA-RD-97-131 Nov. 1, 1997 ERES/Khanzouz/Richter</p> <p>FHWA \$240,003 Common Characteristics of Good and Poorly Performing AC Pavements. Project completed Oct. 1, 1996 FHWA-RD-97-131 Nov. 1, 1997 ERES/Khanzouz/Richter</p> <p>FHWA \$75,000 Evaluation and Characterization of Pavement Drainage (after NCHRP 1-34D). Project completed Dec. 31, 2006 Data Study TBD</p> <p>FHWA \$300,000 Quantify the Impact of Asphalt on Measured Pavement Distresses. Project completed Oct. 1, 1999 Report 583 Dec. 31, 2006 Mohsen/Hanna</p> <p>FHWA \$300,000 Quantify the Impact of Rigid Pavement Design Features on Measured Pavement Distresses. Project completed Oct. 1, 1999 Report 583 Dec. 31, 2006 Mohsen/Hanna</p> <p>C. Guidelines for the selection of pavement design features.</p> <p>Problem Statement Number 7C1 Guidelines for the Selection of Pavement Design Features.</p>

Priorities

Critical (Red), Very High (Orange), High (Yellow), Sequence (Green)

Sequence numbers denote the order in which Analysis Outcomes should be addressed for a given Objective. Analysis Outcomes with the same sequence number can be addressed at the same time.

Legend:

- Blue box: NCHRP project number
- Orange box: FHWA project number
- Green box: Problem Statement Number
- Yellow box: Proposed problem title
- White box: Project duration - Anticipated project start
- White box with red border: Dashed light blue boxes are on-going NCHRP projects that were initiated by the LTPP ETG. Solid Light Blue boxes are completed projects.
- White box with pink border: Dashed pink boxes are on-going NCHRP projects that were directly initiated by other agencies or work groups, but are directly associated with LTPP Data Analysis Plan Strategic Objectives and Analysis Outcomes. Solid Pink boxes are completed projects.
- White box with red border: Dashed white boxes are proposed Research Problem Statements that were developed at LTPP Workshops. (See Note 1) for an explanation of the Problem Statement Numbering scheme.
- White box with blue border: FHWA Technical Support Contract
- White box with orange border: FHWA Project File
- White box with green border: FHWA Project File
- White box with purple border: FHWA Project File

Note:

- Problem Statements are assigned a 3 character number using the convention "O.A.n". "O" is the associated Strategic Objective number (1 through 7), "A" is the associated Analysis Outcome number (A, B, C, etc.) and "n" is an arbitrarily assigned number used for identification purposes. The number "n" does not imply a sequence in which Problem Statements should be addressed.

Additional Notes:

- Hatched orange boxes are planned FHWA projects or data studies that will be funded using LTPP budgeted funds.
- Hatched purple boxes are on-going FHWA projects that were funded using LTPP budgeted funds.
- Thin solid boxes are completed projects with reports pending.
- Thick solid boxes are completed projects with reports published.