Year	Title	Author(s)
2010	Impact of Design Features on Pavement Response and Performance in Rehabilitated Flexible and Rigid Pavements	R. Carvalho, M. Ayres, H. Shirazi, O. Selezneva, M.
2009	Evaluation of International Roughness Index for Asphalt Overlays Placed Over Cracked and Seated Concrete Pavements	Rahim, Ashraf M; Fiegel, Gregg; Ghuzlan, Khalid; Khumann, Dan
2006	Assessment of Overlay Roughness in the LTPP--A Canadian Case Study	Smith, James Trevor; Tighe, Susan L.
2006	Rehabilitation of Asphalt Concrete Pavements: Initial Evaluation of the SPS-5 Experiment--Final Report	Von Quintus, Harold L., et al
2006	Rehabilitation of Jointed Concrete in LTPP Southern Region	Zollinger, Corey; Gardner, Mark; Zollinger, Dan G.
2006	Ride Quality Performance of Asphalt Concrete Pavements Subjected to Different Rehabilitation Strategies	Perera, Rohan W; Kohn, Starr D.
2005	Analysis of Influences on As-Built Pavement Roughness in Asphalt Overlays	Raymond, C. M; Haas, R; Tighe, S. L; Rothenburg, Leo
2005	Anticipation is Sweet: Research Examines Results of Preventative Maintenance on Pavement After 14 Years in Service	Galehouse, L; O'Doherty, J.
2005	Rehabilitation of Jointed Portland Cement Concrete Pavements: SPS-6 -- Initial Evaluation and Analysis	Ambroz, Joanna K; Darter, Michael I.
2005	Selecting Preventive Maintenance Treatments in Texas: Using the Technique for Order Preference by Similarity to the Ideal Solution for Specific Pavement Study–3 Sites	Chang, Jia-Ruey; Chen, Dar-Hao; Hung, Ching-Tsung
2002	LTPP Data Analysis: Effectiveness of Maintenance and Rehabilitation Options	Hall, K. T; Correa, C E; Simpson, A. L.
2001	Getting the Most from Your Long Term Pavement Performance (LTPP) Section - Guidance for Rehabilitation	
2001	LTPP Data Analysis: Factors Affecting Pavement Smoothness	Perera, R. W; Kohn, S. D.
2001	LTPP Maintenance and Rehabilitation Data Review - Final Report	Eltahan, Ahmad A; Von Quintus, Harold L.
2001	Overlay Performance in Canadian Strategic Highway Research Program's Long-Term Pavement Performance Study	Tighe, S; Haas, R; Li, N.
2001	Performance of Arizona's SPS-4 Joint Sealing Environment	Hall, K. T., et al

2000	Comparison of Rehabilitation Strategies for AC Pavements	
2000	Concrete Pavement Performance in the Southeastern United States	Delatte, N. J; Safar-jalani, M; Zinger, N. B.
2000	Insights into Pavement Preservations - A Compendium	
2000	Performance Trends of Rehabilitated AC Pavements	
1999	Effectiveness of Maintenance Treatments of Flexible Pavements	Eltahan, A. A; Daleiden, J. F; Simpson, A. L.
1999	International Roughness Index of Asphalt Concrete Overlays: Analysis of Data from Long-Term Pavement Performance Program SPS-5 Projects	Perera, R. W; Kohn, S. D.
1999	LTPP Pavement Maintenance Materials: SHRP Crack Treatment Experiment, Final Report	Smith, K. L; Romine, A. R.
1999	LTPP Pavement Maintenance Materials: SHRP Joint Reseal Experiment, Final Report	Evans, L. D; Pozsgay, M A; Smith, K. L; Romine, A. R.
1999	LTPP Pavement Maintenance Materials: PCC Partial-Depth Spall Repair Experiment, Final Report	Wilson, T. P; Smith, K. L; Romine, A. R.
1999	LTPP Pavement Maintenance Materials: SPS-4 Supplemental Joint Seal Experiment, Final Report	Smith, K. L; Pozsgay, M. A; Evans, L. D; Romine, A. R.
1999	Performance of Asphalt Overlays in C-SHRP LTPP Experiment	Li, Ningyuan
1999	Portland Cement Concrete (PCC) Partial-Depth Spall Repair	
1999	Resealing Concrete Pavement Joints	
1999	Sealing and Filling Cracks in Asphalt Pavements	
1998	Assessment of the SPS-7 Bonded Concrete Overlays Experiment: Final Report	Smith, T. E; Tayabji, S. D.
1998	Concrete Pavement maintenance Treatment Performance Review: SPS-4 5-Year Data Analysis	Morian, D. A; Gibson, S. D; Epps, J. A.
1998	Long-Term Monitoring of Pavement Maintenance Materials Test Sites	Wilson, T.
1998	Rehabilitation Performance Trends: Early Observations from Long-Term Pavement Performance (LTPP) Specific Pavement Studies (SPS)	Daleiden, J. F; Simpson, A; Rauhut, J. B.
1997	Study of Maintenance Treatments for Asphalt Pavements	Morian, D; Gibson, S; Epps, J.
1995	Rehabilitation of a Jointed Portland Cement	Daleiden, J. F; Ooten, D

	Concrete Pavement on I-35 (Southbound) in Kay County, Oklahoma	A; Sargent, M. D.
1994	Early Analyses of Long-Term Pavement Performance General Pavement Studies Data: Lessons Learned and Recommendations for Future Analyses	Rauhut, J. B; Simpson, A. L; Daleiden, J. F; Darter, M. I; Owusu-Antwi, E; Pendleton, O. J.
1994	Summary Report - 1993 Field Evaluations of SPS-3 and SPS-4 Test Sites	Raza, Hassan
1991	Symposium on PCC Pavement Rehabilitation with HMA Draws National Audience	
1990	Condition Surveys in the Strategic Highway Research Program Long-Term Pavement Performance Study and Pavement Condition Rating for Pre-Overlay Conditions (Abridgment)	Goulias, D. G; Castedo, H; Hudson, W. R.

Title: Evaluation of International Roughness Index for Asphalt Overlays Placed Over Cracked and Seated Concrete Pavements

Author(s): Rahim, Ashraf M; Fiegel, Gregg; Ghuzlan, Khalid; Khumann, Dan

Date: 2009

Publisher: International Journal of Pavement Engineering Vol. 10 No. 3, Taylor & Francis Limited

Abstract/Synopsis:
Crack, seat and overlay (CS&O) is a rehabilitation technique that has been used on jointed plain concrete pavements. Only a few studies have evaluated the surface roughness of pavement sections rehabilitated using this technique. The purpose of this paper was to evaluate the roughness of roadway sections rehabilitated employing the CS&O technique. The data extracted from the long-term pavement performance database were separated based on the weather region and analyzed. Then, international roughness index (IRI) prediction models were developed. A separate model was developed for pavement sections in California. For sections with bound bases, thick overlays provide a smoother surface (lower IRI). However, the effect of the overlay thickness on the IRI for sections with unbound bases does not appear to be considerable. Prediction models developed in this study are shown to provide adequate predictive capabilities. Sections in California have initial IRI values that are lower than those found for sections in the wet-with-freeze (WF) and wet-with-no-freeze (WNF) regions. However, California sections are predicted to develop higher IRI values over time, when compared to those sections in the WF and WNF regions.

Application/Use: This report is applicable for pavement managers for specific cases where CS&O rehabilitation treatments have been applied on pavements.

Contribution: Improvement in Knowledge

Present Benefit: Pavement roughness plays a large role in overall pavement performance. As pavement managers examine potential CS&O rehabilitation projects, it is beneficial to understand how different climate and base conditions may affect the pavement roughness. The LTPP program offered the foundational data for this research project.

Future Benefit: Because pavement roughness can be a large factor on overall pavement condition, the IRI data from the LTPP program will continue to provide a better understanding of how pavement roughness is affected by different pavement conditions.

Title: Impact of Design Features on Pavement Response and Performance in Rehabilitated Flexible and Rigid Pavements

Author(s): R. Carvalho, M. Ayres, H. Shirazi, O. Selezneva, M.

Date: March 2010

Publisher: Federal Highway Administration

Abstract/Synopsis: The primary focus of this research effort was on determining the effects of design and construction features, such as overlay thickness and mix type, presence of milling, type of restoration, on pavement response and performance and on establishing their importance in prediction of future performance of rehabilitated pavements. Long-Term Pavement Performance Program (LTPP) Special Pavement Studies (SPS) SPS -5 and SPS-6 provided a unique source of information to obtain more understanding of the effects of design and construction features on pavement response and performance of rehabilitated flexible and rigid pavements. The research findings provide guidance for identifying appropriate features and rehabilitation alternatives for different pavement types, and recommendations for improving data collection activities. The analyses results obtained in this study help both to determine the causes of distress and to formulate models for predicting performance of rehabilitated pavements. In addition, data from SPS-3 and -4 experiments were used to determine effectiveness and timing of preventive maintenance treatments. The findings suggest that it is possible to determine significant differences between treatment alternatives with respect to pavement performance and treatment timing. Performance of rehabilitated pavement sections from SPS-5 and -6 were also examined using the Mechanistic Empirical Pavement Design Guide (MEPDG) and compared with the field performance. The results provide useful information about rehabilitated pavement section performance predictions and recommendations for future model improvements.

Application/Use: This study is directly applicable to pavement management and pavement maintenance/rehabilitation.

Contribution: Cost Savings; Improvement in Knowledge

Present Benefit: This paper is an example of how LTPP data can be used to better model and predict future performance of rehabilitated pavements. A significant cost savings may be able to be achieved as pavement managers better predict pavement performance of rehabilitated pavements and more strategically allocate the funds needed to achieve the maximum impact on their pavement network.

Future Benefit: The results from this paper provided useful information about rehabilitated pavement performance and recommendations for improving future prediction models. The LTPP database will continue to benefit researchers and designers utilize the data in the coming years. LTPP

Title: Assessment of Overlay Roughness in the LTPP--A Canadian Case Study

Author(s): Smith, James Trevor; Tighe, Susan L.

Date: 2006

Publisher: Federal Highway Administration; American Society of Civil Engineers

Abstract/Synopsis: This paper studies asphalt pavement overlay performance in the Canadian environment. It investigates the impact of asphalt overlay thickness, climatic zone, and subgrade type on the progression of roughness as described by the International Roughness Index (IRI). Data from the Canadian Long-Term Pavement Performance (LTPP) program test sites were analyzed. Through the investigation, pavement factors that significantly impact overlay performance in the Canadian environment can be identified. Data collected over the first 13 years of study were used to show national and provincial roughness trends from 53 test sites. The IRI data were statistically summarized (mean, standard deviation) for each category by the age of the overlay section. Using the summarized data, regression analysis was used to determine an equation that best describes the progression of roughness. Two-factor analysis of variance was used to determine any significant differences within specific categories. The results of the regression analysis were compared to the Canadian Strategic Highway Research Program (C-SHRP) LTPP data to confirm the validity of the roughness progression equations. Results show that overlay thickness and climatic zones significantly impact roughness, while subgrade type has little influence on the IRI values. The roughness progression equations achieved squared correlation coefficients (R^2) between 0.93 and 0.39, demonstrating the accuracy of the model equations.

Application/Use: The results from this paper can be used to understand roughness accumulation and the effects of overlay thickness and climatic zone on this accumulation.

Contribution: Improvement in Knowledge

Present Benefit: Roughness significantly affects the end user's perception on the quality of the pavement. The ability to predict the accumulation of roughness, as well as the factors that contribute to improved ride quality performance, are extremely beneficial to the transportation industry. Roughness predictions can be used as a tool in programming funds for future rehabilitation.

Future Benefit: The LTPP offers approximately 20 years of performance data for in-service pavements. The data can be used to predict performance in areas with limited monitored data. Understanding the contribution of overlay thickness and other factors on roughness will also be beneficial to agencies as they investigate rehabilitation alternatives.

Title: Rehabilitation of Asphalt Concrete Pavements: Initial Evaluation of the SPS-5 Experiment--Final Report

Author(s): Von Quintus, Harold L; Simpson, Amy L; Eltahan, Ahmed A.

Date: 2006

Publisher: Fugro-BRE, Incorporated; Federal Highway Administration

Abstract/Synopsis: The SPS-5 experiment, entitled "Rehabilitation of Asphalt Concrete Pavements," is one of the key experiments of the Long Term Pavement Performance (LTPP) program. The objective of this experiment is to determine the relative influence and long-term effectiveness of different rehabilitation techniques (including overlay thickness, material, and surface preparation) and site conditions (traffic, pre-existing pavement condition, and climatic factors) on performance. This report documents the first comprehensive review and evaluation of data completeness and availability from the SPS-5 experiment. Eighteen SPS-5 projects have been identified. At each site there are nine core test sections. Some SPS-5 projects also have various supplemental sections. 210 test sections are included in the SPS-5 experiment. The data availability and completeness were good overall for the SPS-5 experiment with two exceptions: traffic and materials test data. These data deficiencies need to be addressed before a comprehensive analysis of the SPS-5 experiment is conducted. Both of these data elements must be collected in order for the SPS-5 experiment to meet the expectations for calibrating and validating mechanistic models. The majority of the SPS-5 data that were collected were at level E. Required experiment design factors were compared with the actual experiment design for the large majority of the design factors and can be characterized as good to excellent when comparing designed versus constructed. One project had yet to be constructed and materials testing and data processing still needed to be completed.

Application/Use: This report can be used by those interested in the LTPP SPS-5 experiment. Additionally, the report was intended as a tool for planning data collection at SPS-5 experiments.

Contribution: Improvement in Knowledge

Present Benefit: This evaluation has been used to prioritize data collection on SPS-5 projects within LTPP. Additional materials sampling has been initiated for SPS-5 project along with traffic monitoring through a pooled fund study. These data will provide a more complete matrix for the SPS-5 experiment, making it more valuable to researchers.

Future Benefit: Most asphalt concrete pavement improvements now consist of rehabilitation techniques (as opposed to complete reconstruction). Considering this, it is important to understand the effectiveness of various rehabilitation alternatives and the factors contributing to performance so that the optimum technique can be selected and designed reliably.

Title: Rehabilitation of Jointed Concrete in LTPP Southern Region

Author(s): Zollinger, Corey; Gardner, Mark; Zollinger, Dan G.

Date: 2006

Publisher: American Society of Civil Engineers

Conference Title: Airfield and Highway Pavements. Proceedings of the 2006 Airfield and Highway Pavement Specialty Conference

Abstract/Synopsis: The pavements composing the National Highway System are deteriorating as average daily loads continue to rise. Federal, state, and municipal agencies need greater confidence that rehabilitation options will provide the level of service required for the design life of the treatment. Little information exists to allow qualitative comparisons of the performance of rehabilitation treatments. The objective of this study is to compare the performance of rehabilitated jointed concrete pavements and draw qualitative conclusions as to reasonable expectations for each of the treatment types reviewed.

Application/Use: The findings presented here will be used by those selecting and designing rehabilitation techniques for jointed concrete pavement in the southern United States.

Contribution: Improvement in Knowledge

Present Benefit: The information and findings regarding expected performance and relative comparisons between rehabilitation techniques will benefit the pavement community. Better information on performance life can assist in programming and scheduling rehabilitation. Additionally, agencies can use the findings to determine the most cost-effective strategies to be used within their jurisdiction.

Future Benefit: As existing jointed concrete pavements deteriorate, rehabilitation will need to be considered. The findings of this paper will aide in selecting the most efficient technique given a project's unique conditions and constraints.

Title: Ride Quality Performance of Asphalt Concrete Pavements Subjected to Different Rehabilitation Strategies

Author(s): Perera, Rohan W; Kohn, Starr D.

Date: 2006

Publisher: American Society of Civil Engineers

Conference Title: Airfield and Highway Pavements. Proceedings of the 2006 Airfield and Highway Pavement Specialty Conference

Abstract/Synopsis: Data obtained from SPS-5 projects of the LTPP program were analyzed to evaluate the reduction in roughness achieved for each rehabilitation strategy, and to compare the roughness progression after rehabilitation. The International Roughness Index (IRI) was used to characterize the roughness in this study. A statistical analysis comparing the IRI of the pavement before and after the overlay indicated the IRI of the pavement after overlay did not depend on the pre-rehabilitation IRI, overlay thickness, if milling was performed or not prior to overlay, or the type of asphalt concrete used for the overlay (virgin vs. recycled). The analysis was repeated considering the SPS-5 projects that had a pre-rehabilitation IRI greater than 1.5 m/km, which only considers the rougher projects. A similar result as the previous analysis was obtained in this case too, except that milling prior to overlay was a factor that affected the IRI of the overlaid pavement. An evaluation of roughness progression over a 7-year period after the overlays was performed by using the time-sequence IRI data available for each project. The statistical analysis of data indicated the progression of roughness in the overlaid pavements depend on the pre-overlay IRI of the section and overlay thickness. The analysis did not indicate milling prior to overlay or asphalt concrete type as being significant factors that affect the progression of roughness.

Application/Use: This study is valuable to those involved in selecting and designing rehabilitation alternatives.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The findings from this report are beneficial because they quantify the contribution of various rehabilitation techniques to roughness accumulation. This is important to designers attempting to select the most appropriate alternative with consideration given to end user cost and perception.

Future Benefit: The evaluation conducted as part of this project will continue to be useful. Currently, rehabilitation is the most common type of major asphalt concrete pavement improvement. Quantifying the relationship between strategy and roughness accumulation will be extremely useful in the years to come.

Title: Analysis of Influences on As-Built Pavement Roughness in Asphalt Overlays

Author(s): Raymond, C. M; Haas, R; Tighe, S. L; Rothenburg, Leo

Date: 2005

Publisher: Federal Highway Administration; American Society of Civil Engineers

Abstract/Synopsis: Pavement roughness immediately after construction is a key measure of quality. The use of smoothness specifications requires an understanding of the influences on as-built roughness for both transportation agencies and contractors. This paper uses data from the Long-Term Pavement Performance (LTPP) program to examine four factors and determine their effects on the as-built roughness of a pavement; these factors are: the extent of surface preparation before resurfacing; overlay thickness; type of overlay material; and pavement roughness before resurfacing. Various statistical procedures (including paired data analyses, regression analyses, and a repeated measures analysis) are performed to investigate these effects and any interactive effects. The extent of surface preparation, overlay thickness and pavement roughness before resurfacing are determined to have a statistically significant effect (at a 95% significance level) on the as-built roughness of a pavement either directly or interactively with another variable. The overlay mix type is determined not to have an influence on as-built pavement roughness. Data from the Canadian Long-Term Pavement Performance (C-LTPP) program is used to validate the results for overlay thickness and pavement roughness before resurfacing. A series of prediction equations are also developed to allow for estimating the as-built roughness of a pavement under various conditions. Pavement designers, construction engineers, and contractors should understand the effects that influence the as-built roughness of a pavement so that they can maximize their designs, smoothness specifications, and/or bidding of contracts with smoothness specifications.

Application/Use: This paper can be used by those designing overlay rehabilitation alternatives.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: This paper provides information on the effect of overlay design features on as-built pavement roughness. This information can be used to select overlay design features that reduce as-built roughness. Roughness after construction has a significant impact on the accumulation of roughness over time. Minimizing construction-related roughness can lead to improved roughness performance over time. This results in improved pavement performance and reduced user costs.

Future Benefit: Overlay rehabilitation has become a common practice. Information on the factors that contribute to roughness will continue to be beneficial as overlay construction continues.

Title: Anticipation is Sweet: Research Examines Results of Preventative Maintenance on Pavement After 14 Years in Service

Author(s): Galehouse, L; O'Doherty, J.

Date: 2005

Publisher: Scranton Gillette Communications, Incorporated

Journal Title: Roads & Bridges Vol. 43 No. 6

Abstract/Synopsis: Fourteen years of research on preventative maintenance suggests that when applied early, the strategy will cost less than reconstruction and rehabilitation projects. This article focuses on the Specific Pavement Study-3 (SPS-3) "Preventive Maintenance Effectiveness of Flexible Pavements" project from the Strategic Highway Research Program's (SHRP) Long-Term Pavement Performance (LTPP) Program. The primary objective of the project was to determine the benefits of treating test sections instead of scoring relative performances of different treatments. Study factors such as climatic zones, subgrade type, traffic, initial condition and structural adequacy were examined along with treatments such as slurry seal, chip seal, crack seal and thin hot mix-asphalt (HMA) overlay. Along with general conclusions from the study, the article gives figures showing potential savings in a program emphasizing preventive maintenance over reconstruction, rehabilitation, or resurfacing.

Application/Use: This article can be used by those responsible for maintenance activities as well as those in pavement management.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The SPS-3 experiment provides a side-by-side comparison of various preventative treatments exposed to the same traffic, climate, and in situ conditions. The performance data collected at these projects is extremely beneficial in quantifying the benefits of preventative maintenance.

Future Benefit: The future benefit of this study will be in proper selection and timing of preventative maintenance for a given set of conditions. This will result in improved overall pavement conditions and a lower life cycle cost.

Title: Rehabilitation of Jointed Portland Cement Concrete Pavements: SPS-6 -- Initial Evaluation and Analysis

Author(s): Ambroz, Joanna K; Darter, Michael I.

Date: 2005

Publisher: Applied Research Associates, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Specific Pavement Studies 6 (SPS-6) experiment, "Rehabilitation of Jointed Portland Cement Concrete Pavements," was designed as a controlled field experiment that focuses on the study of specific rehabilitation design features of jointed plain concrete pavements (JPCP) and jointed reinforced concrete pavements (JRCP). This experiment examines the effects of climatic regions (wet-freeze, wet-no freeze, dry-freeze, or dry-no freeze), type of concrete pavement (plain or reinforced), condition of existing pavement prior to rehabilitation (fair or poor), and traffic rate (as a covariant), incorporating the different methods of rehabilitation with and without asphalt concrete (AC) overlays. This report documents the first comprehensive review and evaluation of the SPS-6 experiment. Data availability and completeness for the SPS-6 experiment are good overall. However, some data, such as traffic, climatic, and materials data, are not yet available in the Information Management System (IMS) database. These deficiencies need to be addressed before a comprehensive analysis of the SPS-6 experiment is conducted. However, even though the SPS-6 sections are relatively young, some interesting and important early trends have already been identified that will be useful to the rehabilitation of jointed portland cement concrete pavements. As time and traffic loadings accumulate, much more valuable performance data will be obtained. It is believed that even more results can be obtained if a concerted effort is made to obtain missing data (materials, traffic, climate, and monitoring) and to perform proper analyses of the data. Specific recommendations for further analyses are included.

Application/Use: This report can be used by those interested in the LTPP SPS-6 experiment. Additionally, the report was intended as a tool for assessing data collection needs at SPS-6 experiments.

Contribution: Improvement in Knowledge

Present Benefit: This evaluation has been used to prioritize data collection activities on SPS-6 projects within LTPP. Additional materials sampling has been initiated for these projects along with traffic monitoring through a pooled fund study. These data will provide a more complete matrix for the SPS-6 experiment, increasing its value to researchers.

Future Benefit: It is important to understand the effectiveness of various JPCP rehabilitation alternatives and the factors contributing to performance so that the proper techniques can be selected and designed reliably for specific projects.

Title: Selecting Preventive Maintenance Treatments in Texas: Using the Technique for Order Preference by Similarity to the Ideal Solution for Specific Pavement Study–3 Sites

Author(s): Chang, Jia-Ruey; Chen, Dar-Hao; Hung, Ching-Tsung

Date: 2005

Publisher: Transportation Research Board

Journal Title: Transportation Research Record: Journal of the Transportation Research Board No. 1933

Abstract/Synopsis: Although the cost-effectiveness of preventive maintenance (PM) treatments for pavement is important, literature addressing this issue is limited. Even under the well-controlled Federal Highway Administration (FHWA) Long-Term Pavement Performance (LTPP) study, incomplete data and sections exist. Criteria for selecting PM treatments often conflict and have to be compromised. The multiple criteria decision-making (MCDM) method is one of numerous approaches available for resolving variations of results. The technique for order preference by similarity to ideal solution (TOPSIS), an MCDM method, was used to analyze successfully all 14 specific pavement study (SPS)-3 sites in Texas. The distress score (DS), international roughness index (IRI), and treatment costs were used as criteria to determine the cost-effectiveness of various PM treatments (thin overlay, slurry seal, crack seal, and chip seal). With TOPSIS, the cost-effectiveness of these treatments can be quantified, with variations caused by subjective judgment thus minimized. When all criteria were considered, the most and least cost-effective methods were chip seal and slurry seal, respectively. When cost was not considered, the most and least effective methods were chip seal and crack seal, respectively. The chip seals performed the best. Chip seals had the most forgiving qualities of all the methods, and they yielded no reflection of the cracking that preceded the treatment applications. The evaluation based on TOPSIS provides a viable option for engineers determining the best PM treatments for pavement in need of maintenance.

Application/Use: This study can be used in understanding the effectiveness of preventive maintenance treatments in Texas.

Contribution: Cost Savings, Improvement in Knowledge.

Present Benefit: Proper selection and timing of maintenance treatments can extend pavement performance and reduce life cycle costs. Additionally, some treatments can improve the functional performance of the pavement. This study provides useful information on the effectiveness of treatments applied to pavements in Texas, which can be used to make decisions on maintenance programs.

Future Benefit: The LTPP database provides a means of conducting effectiveness studies like this one. The data will continue to be beneficial to researchers and practitioners in the highway community.

Title: LTPP Data Analysis: Effectiveness of Maintenance and Rehabilitation Options

Author(s): Hall, K. T; Correa, C E; Simpson, A. L.

Date: 2002

Publisher: National Cooperative Highway Research Program

Journal Title: NCHRP Web Document 47

Abstract/Synopsis: This project was conducted to assess the relative performance of different pavement maintenance and rehabilitation treatments, including the influence of pretreatment condition and other factors on treatment effectiveness. The data used in this study were drawn from the Long-Term Pavement Performance (LTPP) Studies' SPS-3 (flexible pavement maintenance), SPS-5 and GPS-6B (flexible pavement rehabilitation), and SPS-6 and GPS-7B (rigid pavement rehabilitation) experiments. The results of this project are presented in this report, which is organized in the following chapters: (1) Introduction and research approach; (2) Flexible pavement maintenance effectiveness; (3) Flexible pavement rehabilitation effectiveness; (4) Rigid pavement rehabilitation effectiveness; and (5) Conclusions. Appendices contain supporting material for the analyses.

Application/Use: This study can be used by pavement management engineers involved with the proper selection and timing of maintenance/rehabilitation treatments.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The LTPP database provides performance data for various maintenance and rehabilitation alternatives. Some of the LTPP experiments offer side-by-side comparisons of treatment alternatives. This allows a direct comparison while keeping other factors (such as subgrade, traffic, and climate) constant. The results can be used to determine the most cost-effective treatments based on life cycle cost analysis.

Future Benefit: These experiments can also be used to predict the expected service life of treatments based on in situ conditions. By knowing the expected life, pavement management engineers can develop proper timing intervals and determine budgetary needs.

Title: Getting the Most from Your Long Term Pavement Performance (LTPP) Section - Guidance for Rehabilitation

Date: 2001

Publisher: Federal Highway Administration

Abstract/Synopsis: Pavement rehabilitation in a number of States and Provinces consumes the majority of the pavement funds. Highway agencies have many questions related to selecting the right rehabilitation strategy considering the pavement condition, traffic, and desired performance period. In response to this need, one of the Long Term Pavement Performance (LTPP) program's objectives is to develop improved design methodologies and strategies for the rehabilitation of existing pavements. Of the approximately 2,400 LTPP sections, there are 442 rehabilitated pavement sections in the GPS-6 and -7 and SPS-5 and -6 experiments. These 442 are the source of the data used to address LTPP's goal. An increase in the quality and applicability of the LTPP rehabilitation products requires an increase in the number of rehabilitated test sections in the LTPP program while not increasing the total number of sections in the program. A means to increase the number of rehabilitated sections is to continue to monitor an LTPP section after the State or Province has completed pavement rehabilitation. For an LTPP test section to be considered for future monitoring after rehabilitation, three criteria must be met: (1) the rehabilitation treatment must fall within certain types and ranges, (2) the section rehabilitation must be completed and open to traffic by the end of 2002, and (3) the State or Province must meet certain data collection responsibilities.

Application/Use: This report is useful to those interested in rehabilitation of LTPP test sections.

Contribution: Improvement in Knowledge; Implementation/Usage.

Present Benefit: The report provides insight into the criteria used to determine if LTPP test sections were candidates for further monitoring after rehabilitation activities were conducted.

Future Benefit: The rehabilitation data in the LTPP database will provide a comprehensive source of data to evaluate the effectiveness of rehabilitation activities as well as factors affecting performance of rehabilitated pavements.

Title: LTPP Data Analysis: Factors Affecting Pavement Smoothness

Author(s): Perera, R. W; Kohn, S. D.

Date: 2001

Publisher: National Cooperative Highway Research Program; Soil and Materials Engineers, Incorporated

Journal Title: NCHRP Web Document 40

Abstract/Synopsis: In this research project, data available in the Long Term Pavement Performance (LTPP) Information Management System (IMS) were used to determine the effect of factors such as design and rehabilitation parameters, climatic conditions, traffic levels, material properties, and extent and severity of distress that cause changes in pavement smoothness. For the purposes of this research, the International Roughness Index (IRI) was used as the measure of pavement smoothness. The LTPP program consists of two complementary programs, the General Pavement Studies (GPS) and Specific Pavement Studies (SPS). Chapter 1 of this project report provides an introduction. Chapter 2 presents the review of literature related to factors affecting pavement smoothness and roughness development in pavements. Chapter 3 presents the data elements that were selected for analysis and data synthesis methods that were used with the data obtained from the IMS. Chapter 4 presents the data analysis methods that were utilized during the study. Chapter 5 ments, and describes the results obtained from the SPS-1 and SPS-2 experiments. Chapter 6 describes roughness rehabilitated pavements, and describes results obtained from SPS-5 and SPS-6 experiments. Chapter 7 presents the results obtained for GPS experiments in the first design phase, which are GPS experiments 1 through 5. Chapter 8 presents the results obtained for GPS experiments 6 and 7, which are overlaid pavements. Chapter 9 presents the conclusions and recommendations for future research.

Application/Use: This study is valuable to those involved in selecting and designing pavements, including rehabilitation alternatives.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The findings from this report are beneficial because they quantify the contributionovidvarious design parameters as well as rehabilitation techniques to roughness accumulation. This is important to designers attempting to select the most appropriate alternative with consideration given to end user cost and perception.

Future Benefit: The evaluation conducted as part of this project will continue to be useful. Currently, rehabilitation is the most common type of major asphalt concrete pavement improvement. Quantifying the relationship between strategy and roughness accumulation will prove to be beneficial in the years to come. This information can be used to select treatment options that will provide pavements that remain smoother for longer periods vid time.

Title: LTPP Maintenance and Rehabilitation Data Review - Final Report

Author(s): Eltahan, Ahmad A; Von Quintus, Harold L.

Date: 2001

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: Since its inception, the Long Term Pavement Performance (LTPP) program has collected maintenance and rehabilitation (M&R) data on all test sections included in the LTPP program. To date, there has been no detailed review of the M&R data elements. This report provides a detailed review of the M&R data and presents the findings from that review. A total of 757 test sections have undergone some type of M&R activity. Of these test sections, only 23 anomalies were found. These anomalies consist primarily of sections that have patching recorded in the M&R tables, but no increase in patching area or number in the distress surveys. All of the M&R data tables for these 757 test sections were reviewed for data completeness. For most of these test sections, several fields are missing in almost all of the tables. A detailed list of the missing data fields is included as an appendix to the report. Although it might be difficult to obtain these data for the older M&R activities, an attempt should be made to collect the essential data elements, as a minimum. The distress monitoring data and International Roughness Index (IRI) values were reviewed for those test sections without any known M&R activity. The number of these test sections exceeded 1800. A review of the data from these test sections was completed to identify those sections that may have had some type of M&R treatment, but for which no treatment is recorded in the LTPP database. A total of 275 anomalies of this type were identified. Over 80 percent of these anomalies were found to be the result of an increase in patching from the distress surveys in the absence of any patching record in the M&R tables.

Application/Use: This study was used to improve the quality of data in the LTPP database.

Contribution: Improvement in Knowledge

Present Benefit: This evaluation was beneficial in improving the quality of data reported in the LTPP database.

Future Benefit: The availability of quality data will continue to provide benefit as future research projects use LTPP data.

Title: Overlay Performance in Canadian Strategic Highway Research Program's Long-Term Pavement Performance Study

Author(s): Tighe, S; Haas, R; Li, N.

Date: 2001

Publisher: Transportation Research Board

Journal Title: Transportation Research Record No. 1778

Abstract/Synopsis: The Canadian Long-Term Pavement Performance (C-LTPP) study, initiated in 1989, involves 65 sections in the 24 provincial sites that received rehabilitation comprising various thicknesses of asphalt overlays. The effects of the various alternative rehabilitation treatments on pavement performance in terms of roughness progression under comparative traffic loading, climate, and subgrade soil conditions are described. Roughness trends are the main subject of the C-LTPP study. Progression of roughness for thin overlays (30 to 60 mm) is significantly higher on a national basis than for medium (60 to 100 mm) and thick (100 to 185 mm) overlays. Factor effects, including climatic zone, subgrade type, and traffic level were also evaluated. Some findings are that (a) in wet, high-freeze zones, thinner overlays show a higher rate of roughness progression than thicker overlays, regardless of subgrade type; (b) in dry, high-freeze zones, roughness progression for medium and thick overlays is relatively small; (c) in wet, low-freeze zones, thinner overlays combined with a fine subgrade show the highest rate of roughness progression; (d) traffic in terms of equivalent single-axle loads (ESALs) appeared to have a limited effect for all the preceding factors--this was attributed largely to all the traffic essentially falling into one level and to the designation of 200,000 ESALs per year as the boundary between low and high traffic levels. In conclusion, the C-LTPP experiment has provided valuable information on roughness trends after only 8 years of observations. The methodology developed in this study for pavement roughness evaluation can be applied to performance trends analysis of other measured LTPP data.

Application/Use: The results from this paper can be used to understand roughness accumulation and the effects of overlay thickness and climatic zone on this accumulation.

Contribution: Improvement in Knowledge

Present Benefit: Roughness significantly affects the end user's perception on the quality of the pavement. The ability to predict the accumulation of roughness, as well as the factors that contribute to improved ride quality performance, are extremely beneficial to the transportation industry. Roughness predictions can be used as a tool in programming funds for future rehabilitation activities.

Future Benefit: The LTPP offers approximately 20 years of performance data for in-service pavements. The data can be used to predict performance in areas with limited monitored data. Understanding the contribution of overlay thickness and other factors on roughness will also be beneficial to agencies as they investigate rehabilitation alternatives.

Title: Performance of Arizona's SPS-4 Joint Sealing Environment

Author(s): Hall, K. T; Evans, L. D; Crovetti, J. A; Correa, C. E; Scofield, L.

Date: 2001

Publisher: International Society for Concrete Pavements

Conference Title: Seventh International Conference on Concrete Pavements. The Use of Concrete in Developing Long-Lasting Pavement Solutions for the 21st Century

Abstract/Synopsis: This paper describes how Arizona is one of four states that has built and monitored experimental concrete pavement test sections with sealed and unsealed joints as supplements to the LTPP SPS-4 experiment. The supplemental experiments in three of these states differ from the other SPS-4 sites in that the pavements were constructed for the experiment, and incorporate a variety of joint sealant types and joint configurations, as well as narrow unsealed joints. The performance of concrete pavement test sections and the joint sealants at the Arizona SPS-4 site has been monitored since the pavement's construction in 1991. This monitoring has included deflection testing, distress surveying, profile measurement, test section length measurement, joint width measurement, and joint sealant condition evaluation. The paper presents the findings from nine years of monitoring of the performance of the pavements and joint sealants at the Arizona SPS-4 site.

Application/Use: The report can be used by Arizona in determining the cost-effectiveness of jointed concrete pavement maintenance alternatives.

Contribution: Cost Savings; Improvement in Knowledge; Lessons Learned.

Present Benefit: This study provides information on differential performance between various maintenance alternatives in Arizona. This is beneficial to pavement management in setting policy for the use of jointed concrete pavement maintenance. Life-cycle cost analysis provides useful information on cost-effective solutions.

Future Benefit: The results can be used to implement maintenance strategies. This will result in better overall condition of jointed concrete pavement. Additional benefit will be realized in cost savings through proper treatment selection.

Title: Comparison of Rehabilitation Strategies for AC Pavements

Date: 2000

Publisher: Federal Highway Administration

Journal Title: Tech Brief

Abstract/Synopsis: This Tech Brief summarizes the results of a study of the Specific Pavement Study 5 (SPS-5) experiment entitled, "Performance of Rehabilitated Asphalt Concrete Pavements in the LTPP Experiments--Data Collected Through February 1997." The study documents performance trends of the 17 SPS-5 projects using distress data collected through February 1997. The age of these SPS-5 projects vary from 0.1 to 6.1 years, but most are less than four years old. Each project has nine test sections. The nine test sections consist of one control section and eight test sections with different combinations of the following strategies: Thin (51-mm) and thick (127-mm) overlays; Virgin and recycled mixtures used for the overlay; and Milled and non-milled surfaces prior to overlay placement.

Application/Use: The findings from this study are directly applicable to pavement rehabilitation design.

Contribution: Cost Savings; Lessons Learned.

Present Benefit: The early performance trends developed for the various rehabilitation treatments that make up the SPS-5 experiment can be used to evaluate life cycle cost differences between the alternatives. Agencies can use this information to make policy decisions on design practices for flexible pavement rehabilitation.

Future Benefit: The SPS-5 experiment will be beneficial in implementing and calibrating the M-E PDG for flexible pavement rehabilitation. The performance data collected at the sites coupled with material properties, traffic, and climatic data can be used to conduct local validation and calibration of the M-E PDG.

Title: Concrete Pavement Performance in the Southeastern United States

Authors: Delatte, N. J; Safarjalani, M; Zinger, N. B.

Date: 2000

Publisher: University of Alabama, Birmingham; University Transportation Center for Alabama

Abstract/Synopsis: This report documents an in-depth study of the performance of concrete pavements in the southeastern United States. Information from the Strategic Highway Research Program (SHRP) Long Term Pavement Performance (LTPP) database was investigated. Analysis of 36 sections in Alabama, Florida, Georgia, Mississippi, and North and South Carolina showed that the majority of these pavements are providing excellent service well beyond their original design lives. This has important implications for new pavement construction, as well as maintenance and rehabilitation of existing pavements. For new pavement construction, the results of this study suggest that life cycle cost models should assume better performance and longer service life than existing AASHTO predictions for these pavements. Thus, the economic benefits of constructing concrete pavements where heavy traffic is anticipated or long life is desired may be considerable. The implication for maintenance and rehabilitation of existing pavements is that concrete pavements may have considerably more remaining structural capacity than time in service or traffic applied to the pavement would suggest. For this reason, expensive and time-consuming reconstruction efforts or thick overlays should not be used unless the evaluation of pavement condition indicates it is warranted. If the pavement is in good structural condition, diamond grinding and other rapid, low cost Concrete Pavement Restoration (CPR) alternatives may extend pavement life considerably and improve serviceability.

Application/Use: This study is directly related to the design and maintenance of rigid pavements in the southern United States.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: This study provides information on the differences between design and actual service lives for rigid concrete pavements. This information can help designers and pavement managers make informed decisions on the most cost-effective pavement design based on life cycle cost analysis.

Future Benefit: The study will continue to add benefit as agencies begin implementing the M-E PDG. It is important to calibrate the new guide to actual performance (given regional input parameters) and this report provides information that may be helpful in that regard.

Title: Insights into Pavement Preservations - A Compendium

Date: 2000

Publisher: Federal Highway Administration

Abstract/Synopsis: This compendium is meant to provide a short, nontechnical survey of recent articles on pavement preservation for use by members of the highway community - as well as the general public - who have an interest in this topic, but not necessarily a technician's background. The following 9 articles are included in the compendium: Pavement Preservation: Preserving our Investment in Highways, by RM Davies and J Sorenson; Mapping the Road to Pavement Preservation; Road Map for Pavement Preservation, by J Sorenson; Preventive Maintenance Means Smooth Driving in Georgia; Preventive Maintenance Yields Huge Savings, says Michigan Study; Videotape Portrays Preventive Maintenance as Key to Long-Lasting Pavements; FHWA Teams up to Promote Preventive Maintenance, by J Sorenson; FHWA and Industry to Cosponsor Pavement Preventive Maintenance Workshops; and LTPP Findings Help Kansas DOT Improve Pavement Maintenance Practices.

Application/Use: This compendium provides information on a wide array of preservation topics that are helpful to highway agencies.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Effective preventative maintenance can result in significant savings and improved pavement performance on a network level. The LTPP program includes maintenance alternatives for both rigid and flexible pavements. Findings from these experiments can be applied to maintenance programs in highway agencies and local jurisdictions.

Future Benefit: Preventative maintenance improvements will continue to add benefit by reducing costs and improving performance. The LTPP database provides the resources needed to evaluate life-cycle costs and performance differences that are useful in pavement management.

Title: Performance Trends of Rehabilitated AC Pavements

Date: 2000

Publisher: Federal Highway Administration

Journal Title: TechBrief

Abstract/Synopsis: A primary objective of the Long Term Pavement Performance (LTPP) program is to develop improved design methodologies and strategies for the rehabilitation of existing pavements. One of the experiments designed to address this objective is General Pavement Study (GPS) 6. This TechBrief summarizes the results of a study of the GPS-6 experiment, entitled "Performance of Rehabilitated Asphalt Concrete Pavements in the LTPP Experiments--Data Collected Through February 1997." The study documents performance trends of the 125 GPS-6 test sections using distress data collected through February 1997. The test sections represent a diverse range of conditions. The age of the asphalt concrete overlays range from 0.1 to 26.4 years (with an overall mean age of 7.3 years), while the traffic levels range from 10 to 1,900 thousand equivalent single-axle loads (KESALs) per year (with an overall mean of 300 KESALs per year). Six distress types were used to evaluate the performance trends of the LTPP GPS-6 test sections: fatigue cracking, longitudinal cracking in the wheelpath, longitudinal cracking not in the wheelpath, transverse cracking, rutting, and roughness [as measured by the International Roughness Index (IRI)].

Application/Use: The findings from this study are directly applicable to pavement rehabilitation design.

Contribution: Cost Savings; Lessons Learned.

Present Benefit: The early performance trends developed for standard agency rehabilitation practices that make up the GPS-6 experiment can be used to evaluate life cycle cost differences between the alternatives. Agencies can use this information to make policy decisions on design practices for flexible pavement rehabilitation.

Future Benefit: The GPS-6 experiment will be beneficial in implementing and calibrating the M-E PDG for flexible pavement rehabilitation. The performance data collected at the sites coupled with material properties, traffic, and climatic data can be used to locally validate and calibrate the M-E PDG to the standard rehabilitation practices of the region.

Title: Effectiveness of Maintenance Treatments of Flexible Pavements

Authors: Eltahan, A. A; Daleiden, J. F; Simpson, A. L.

Date: 1999

Publisher: Transportation Research Board

Journal Title: Transportation Research Record No. 1680

Abstract/Synopsis: To achieve effective pavement maintenance, the life expectancy and timing of treatment applications need to be determined. The Long Term Pavement Performance (LTPP) program includes the Specific Pavement Study-3 (SPS-3), which focuses on this subject. The treatments applied are chip seals, crack seals, slurry seals, and thin overlays. In studying the life expectancy it is not feasible to wait for all the sections in the experiment to fail. Thus, there is a need to determine the life expectancy while making efficient use of the available data collection funds. Survival data analysis is a statistical technique that meets this need by accounting for the portion of the sections in which the exact time the treatment lasted is not known. The application of this technique to flexible-pavement maintenance is presented. In addition, some results of the LTPP SPS-3 experiment are presented to the highway community. The focus is on the LTPP Southern Region (Alabama, Arkansas, Florida, Mississippi, Oklahoma, Tennessee, and Texas). The results showed that the probability of failure was two to four times higher for the sections that were in poor condition at the time the treatment was applied than those sections that were in better condition. The median survival times for thin overlays, slurry seals, and crack seals were 7, 5.5, and 5 years, respectively. The chip-seal sections had not yet reached the 50% failure probability after 8 years of the SPS-3 experiment. Accordingly, chip seals appear to have outperformed the other treatments investigated in this study in delaying the reappearance of distress.

Application/Use: This report can be used by states in the southern United States interested in maintenance alternatives for flexible pavements.

Contribution: Cost Savings; Improvement in Knowledge; Lessons Learned.

Present Benefit: This study quantifies performance differences between various maintenance alternatives, which can be used to determine cost differences based on life cycle cost analysis. Agencies can use this information to determine the most cost-effective treatments along with the proper activity timing.

Future Benefit: Improvements in the selection and timing of maintenance treatments will continue to improve the overall condition of the pavement network at reduced costs.

Title: International Roughness Index of Asphalt Concrete Overlays: Analysis of Data from Long-Term Pavement Performance Program SPS-5 Projects

Authors: Perera, R. W; Kohn, S. D.

Date: 1999

Publisher: Transportation Research Board

Journal Title: Transportation Research Record No. 1655

Abstract/Synopsis: The Specific Pavement Studies 5 (SPS-5) experiment in the Long-Term Pavement Performance (LTPP) program was developed to investigate the performance of selected asphalt concrete rehabilitation treatment factors. Results of an analysis are presented that was conducted to compare the International Roughness Index (IRI) values of the test sections before and after overlay and to compare the IRI values that were obtained on the test sections subjected to different treatments. The data presented will be useful for highway agencies to gain an insight into the typical IRI values that can be expected when overlays are placed on asphalt concrete pavements and to obtain information on the reduction in roughness from an asphalt concrete overlay. The analysis indicated that the IRI of a pavement after overlay was not a function of the IRI before overlay. It was observed that a 50-mm-thick overlay (placed in one lift) was capable of achieving similar IRI values as a 125-mm-thick overlay (placed in two lifts). No differences in IRI values were obtained on overlays that were placed on pavement surfaces milled before the overlay when compared with surfaces not milled before the overlay. A frequency analysis of the IRI values after overlay indicated that in 85 percent of the cases, the IRI of the pavement was less than 1.2 m/km for both 50-mm- and 125-mm-thick asphalt concrete overlays.

Application/Use: This study is valuable to those involved in selecting and designing rehabilitation alternatives.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The findings from this report are beneficial because they quantify the contribution of various rehabilitation techniques to roughness accumulation. This is important to designers attempting to select the most appropriate alternative with consideration given to end user cost and perception.

Future Benefit: The evaluation conducted as part of this project will continue to be useful. Quantifying the relationship between rehabilitation strategy and roughness accumulation will be quire valuable in making design decisions.

Title: LTPP Pavement Maintenance Materials: SHRP Crack Treatment Experiment, Final Report

Authors: Smith, K. L; Romine, A. R.

Date: 1999

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program (SHRP) H-106 maintenance experiment and the Federal Highway Administration (FHWA) Long-Term Monitoring (LTM) of Pavement Maintenance Materials Test Sites project studied two distinct asphalt concrete (AC) crack treatments: transverse crack sealing and longitudinal crack filling. Both activities are performed frequently in order to extend pavement life by preventing or substantially reducing the infiltration of water into the pavement structure. Highway agencies use different materials and methods to treat cracks in AC pavements, and some of these treatments are inherently better than others; however, the relative effectiveness of a treatment often depends on the situations or conditions under which they are used. The primary objective of the H-106/LTM crack treatment experiment, then, was to determine the most effective and economical materials and methods for conducting crack sealing and crack filling operations. Secondary objectives included the identification of both performance-related material tests and quicker, safer installation practices. This report documents the entire AC crack treatment study, including the installation of 31 unique crack treatments (i.e., combinations of sealant/filler materials and installation method) at 5 different test sites, the laboratory testing of experimental sealant/filler materials, and the 7-year performance monitoring of the various crack treatments. It also discusses the results of comprehensive statistical analyses conducted on material performance and laboratory testing data. The results of a detailed cost-effectiveness analysis are also presented.

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate crack sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Findings from the project provide an understanding of how material properties and installation techniques affect crack sealant performance. With this information, pavement maintenance and management engineers can modify standard specifications and other agency policies to improve crack sealant performance. By doing this, agencies can optimize crack sealing operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify crack sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: LTPP Pavement Maintenance Materials: SHRP Joint Reseal Experiment, Final Report

Authors: Evans, L. D; Pozsgay, M A; Smith, K. L; Romine, A. R.

Date: 1999

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program (SHRP) H-106 maintenance experiment and the Federal Highway Administration (FHWA) Long-Term Monitoring (LTM) of Pavement Maintenance Materials Test Sites project studied the resealing of joints in concrete pavements. The purpose of joint resealing is to reduce the amount of water entering a pavement structure and to prevent the filling of joints with incompressible materials. Although joint resealing is a common maintenance practice, premature seal failure is frequent, leading to additional repair and expenditures. The purpose of this study, then, was to address the merits and deficiencies of current joint resealing materials, designs, and practices. The study evaluated the relative performance of selected sealant materials, as well as the effect of selected sealant installation methods. The study also identified sealant material properties and tests that correlate well with field performance. The effect of joint seal performance on pavement life was not addressed in this study. This report documents the entire PCC joint resealing study, including the installation of 31 unique joint seal treatments (i.e., combinations of sealant material and installation method) at 5 different test sites, the laboratory testing of experimental sealant materials, and the 7-year performance monitoring of the various joint seal treatments. It also discusses the results of comprehensive statistical analyses conducted on material performance and laboratory testing data. The results of a detailed cost-effectiveness analysis are also presented.

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate joint sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge; Lessons Learned.

Present Benefit: Findings from this project are beneficial in understanding how material properties and installation techniques affect joint sealant performance. With this information, pavement maintenance and management engineers can modify standard specifications and other agency policies to improve joint sealant performance. By doing this, agencies can optimize joint sealant operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify joint sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: LTPP Pavement Maintenance Materials: PCC Partial-Depth Spall Repair Experiment, Final Report

Authors: Wilson, T. P; Smith, K. L; Romine, A. R.

Date: 1999

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program (SHRP) H-106 maintenance experiment and the Federal Highway Administration (FHWA) Long-Term Monitoring (LTM) of Pavement Maintenance Materials Test Sites project studied the repair of partial-depth spalls in concrete pavements. The purpose of partial-depth spall repair is to restore a pavement's structural integrity, improve its ride quality, and extend its serviceable life. Highway agencies spend a large amount of time and money annually performing partial-depth spall repairs, both as temporary and permanent fixes. Frequently, the repairs are not made as efficiently as desired or do not perform as long as intended. The primary consequences are added disruption to traffic, more exposure of patching crews to traffic, and additional maintenance expenditures. The purpose of this study, then, was to address the merits and deficiencies of current spall repair materials, designs, and practices. The study evaluated the relative performance of selected patching materials, as well as the effect of selected repair methods. The study also examined repair material properties and tests that correlate well with field performance. This report documents the entire Portland Cement Concrete (PCC) partial-depth spall repair study, including the installation of 30 unique repair types (i.e., combinations of patching material and patching method) at 4 different test sites, the laboratory testing of experimental repair materials, and the 7-year performance monitoring of the various partial-depth repairs. It also discusses the results of comprehensive statistical analyses conducted on material performance and laboratory testing data. The results of a detailed cost-effectiveness analysis are also presented.

Application/Use: This report can be used by State Highway Agencies to evaluate existing spall repair techniques.

Contribution: Cost Savings; Improvement in Knowledge; Lessons Learned.

Present Benefit: Findings from this evaluation are beneficial to pavement maintenance and management engineers in determining the most cost-effective spall repair methods to implement. By changing policies and standard specifications, agencies can improve performance of the repair activities while reducing costs.

Future Benefit: This report documents performance of spall repair techniques, which will provide future benefit in improving pavement performance and reducing operating costs. The proper selection of repair material and technique will result in longer service from maintenance treatments and will reduce the exposure of maintenance crews to highway traffic.

Title: LTPP Pavement Maintenance Materials: SPS-4 Supplemental Joint Seal Experiment, Final Report

Authors: Smith, K. L; Pozsgay, M. A; Evans, L. D; Romine, A. R.

Date: 1999

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program (SHRP) Specific Pavement Studies (SPS)-4 preventive maintenance experiment was established to determine the benefits and cost-effectiveness of concrete maintenance activities, such as joint sealing and slab undersealing. Since 1989, several test sites have been constructed throughout the United States for this purpose. A secondary investigation at some of these SPS-4 sites has focused on the long-term effectiveness of various joint seal treatments (i.e., combinations of sealant material and installation method) at preventing the infiltration of water into the pavement structure. Referred to as supplemental joint seal sites, a total of six such sites were constructed adjacent to SPS-4 test sites, and the performance of the various joint seal treatments have been monitored under the Federal Highway Administration (FHWA) Long-Term Monitoring (LTM) of Pavement Maintenance Materials Test Sites project. This report documents the entire SPS-4 supplemental joint seal study, including the installation of 29 unique joint seal treatments, the laboratory testing of experimental sealant materials, and the multi-year performance monitoring of the various joint seal treatments. It also discusses the results of comprehensive statistical analyses conducted on sealant material performance.

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate joint sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Findings from this project are beneficial in understanding how material properties and installation techniques affect joint sealant performance. With this information, pavement maintenance and management engineers can modify standard specifications and other agency policies to improve joint sealant performance. By doing this, agencies can optimize joint sealant operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify joint sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: Performance of Asphalt Overlays in C-SHRP LTPP Experiment

Authors: Li, Ningyuan

Date: 1999

Publisher: Canadian Technical Asphalt Association

Conference Title: Proceedings of the Annual Conference of Canadian Technical Asphalt Association

Abstract/Synopsis: No abstract provided.

Application/Use: The results from this paper can be used to understand roughness accumulation and the effects of overlay thickness and climatic zone on this accumulation.

Contribution: Improvement in Knowledge

Present Benefit: Roughness significantly affects the end user's perception on the quality of a pavement. The ability to predict the accumulation of roughness, as well as the factors that contribute to improved ride quality performance, are extremely beneficial to the transportation industry. Roughness predictions can be used as a tool in programming funds for future rehabilitation activities.

Future Benefit: The LTPP offers approximately 20 years of performance data for in-service pavements. The data can be used to predict performance in areas with limited.

Title: Portland Cement Concrete (PCC) Partial-Depth Spall Repair

Date: 1999

Publisher: Federal Highway Administration

Journal Title: TechBrief

Abstract/Synopsis: The primary aim of the partial-depth spall repair study was to determine the most effective and economical materials and procedures for placing quality, long-lasting partial-depth patches in jointed concrete pavements. A secondary objective of the study was to identify any performance-related material tests that would enhance the material selection process and provide a better guarantee of patch performance. This technical summary summarizes the key benefits of this research, the experiment design, the evaluations performed, key findings, and recommendations from this research. This TechBrief is based on the report, "LTPP Pavement Maintenance Materials: SHRP PCC Partial-Depth Spall Repair Experiment, Final Report" (FHWA-RD-99-153; TRIS 00778832).

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate joint sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Findings from this project are beneficial in understanding how material properties and installation techniques affect joint sealant performance. With this information pavement, maintenance and management engineers can modify standard specifications and other agency policies to improve joint sealant performance. By doing this, agencies can optimize joint sealant operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify joint sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: Resealing Concrete Pavement Joints

Date: 1999

Publisher: Federal Highway Administration

Journal Title: TechBrief

Abstract/Synopsis: The primary objective of this study was to evaluate the relative performance of the selected joint sealant materials. Other objectives were to determine the effect of selected sealant configurations and installation methods, and to identify sealant material properties and tests that correlate well with field performance. This technical summary briefly summarizes the key benefits of this research, the research approach, the key findings, and the recommendations from this research. In addition to the evaluation of overall seal performance, a service-life comparison was performed. A table showing the projected service life in months for tested joint sealants is provided in this TechBrief. This TechBrief is based on the report "LTPP Pavement Maintenance Materials: SHRP Joint Reseal Experiment, Final Report" (FHWA-RD-99-142; TRIS 00778829).

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate crack sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Findings from the project are helpful in understanding how material properties and installation techniques affect crack sealant performance. With this information, pavement maintenance and management engineers can modify standard specifications and other agency policies to improve crack sealant performance. By doing this, agencies can optimize crack sealing operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify crack sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: Sealing and Filling Cracks in Asphalt Pavements

Date: 1999

Publisher: Federal Highway Administration

Journal Title: TechBrief

Abstract/Synopsis: The primary objective of the crack treatment experiment was to determine the most effective and economical materials and methods for conducting crack-sealing and crack-filling operations. Secondary objectives included the identification of performance-related material tests and quicker, safer installation practices. This technical summary summarizes the key benefits of this research, the experiment design, the evaluations performed, the service life comparison, key findings, and recommendations from this research. This TechBrief is based on the report, "LTPP Pavement Maintenance Materials: SHRP AC Crack Treatment Experiment, Final Report" (FHWA-RD-99-143; TRIS 00778830).

Application/Use: This study can be used by pavement maintenance and pavement management engineers to evaluate crack sealing techniques and materials.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: Findings from the project are useful in understanding how material properties and installation techniques affect crack sealant performance. With this information, pavement maintenance and management engineers can modify standard specifications and other agency policies to improve crack sealant performance. By doing this, agencies can optimize crack sealing operations and improve cost-efficiency.

Future Benefit: As agencies use the information presented in this report to modify crack sealant operations, additional benefit could be realized in better performing pavement structures and reduced maintenance costs.

Title: Assessment of the SPS-7 Bonded Concrete Overlays Experiment: Final Report

Authors: Smith, T. E; Tayabji, S. D.

Date: 1998

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: This report presents an assessment of the Long-Term Pavement Performance (LTPP) SPS-7 experiment. This report is intended to serve as background material for a meeting of State agencies to be held to review the status of the SPS-7 experiment. The four SPS-7 projects are described in detail and an assessment is provided on the availability and quality of data for these four projects. The scope of work for this study did not include data analysis.

Application/Use: This document was used as a planning and education tool for the LTPP program and State Highway Agencies.

Contribution: Improvement in Knowledge

Present Benefit: The document is useful in understanding the LTPP SPS-7 experiment and the status of the project as of 1998. This information was required to properly plan future activities for the experiment.

Future Benefit: Data collected at SPS-7 projects will provide valuable data on bonded concrete overlays. This information can be used to model performance, understand the contribution of design or in situ features on deterioration, and provide insight to pavement design and management personnel.

Title: Concrete Pavement maintenance Treatment Performance Review: SPS-4 5-Year Data Analysis

Authors: Morian, D. A; Gibson, S. D; Epps, J. A.

Date: 1998

Publisher: Nichols Consulting Engineers, Chartered; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program developed and coordinated construction of test sections for rigid pavement maintenance throughout the United States and Canada. Test sites included specific test sections for evaluation of the performance of undersealing and joint sealing as maintenance treatments. Each site also included an unsealed control section. This report discusses the project background and analysis of monitoring data collected over a 5-year period by the Long Term Pavement Performance (LTPP) project at SPS-4 sites throughout the United States and Canada. The analysis considers three important characteristics of the maintenance treatments: treatment performance, timing of application, and cost effectiveness. In addition to data analysis results, the report conclusions include information from "Pavement Treatment Effectiveness, 1995 SPS-3 and SPS-4 Site Evaluations, National Report" (May 1997).

Application/Use: This report can be used by those interested in maintenance alternatives for rigid pavements.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: This study investigates performance differences between various maintenance alternatives, which can be used to determine cost differences based on life cycle cost analysis. Agencies can use this information to determine the most cost-effective treatments along with the proper activity timing.

Future Benefit: Improvements in the efficient selection and timing of maintenance treatments will continue to improve the overall condition of the pavement network at reduced costs.

Title: Long-Term Monitoring of Pavement Maintenance Materials Test Sites

Authors: Wilson, T.

Date: 1998

Publisher: ERES Consultants, Incorporated; Federal Highway Administration

Abstract/Synopsis: The Strategic Highway Research Program's (SHRP's) H-106 pothole repair experiment was part of the most extensive pavement maintenance experiment ever conducted. Started under SHRP and continued under the Long-Term Pavement Performance (LTPP) program's Long-Term Monitoring project, it provides valuable data on the performance and cost-effectiveness of various cold-mix materials and procedures for repairing asphalt concrete-surfaced pavements. The information derived from this study will contribute greatly toward advancing the state of the practice of response-type pothole-patching operations.

Application/Use: This is directly applicable to pavement maintenance activities.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The LTPP database provides a comprehensive source of pavement performance data including maintenance treatments. This information can be used to quantify performance differences from maintenance treatments. The information is useful in optimizing maintenance activities and understanding cost-to-benefit of various treatments.

Future Benefit: Performance trends in the LTPP database can be used to supplement pavement management systems. The information can be used to make policy decisions on pavement maintenance treatments and timings.

Title: Rehabilitation Performance Trends: Early Observations from Long-Term Pavement Performance (LTPP) Specific Pavement Studies (SPS)

Authors: Daleiden, J. F; Simpson, A; Rauhut, J. B.

Date: 1998

Publisher: Brent Rauhut Engineering, Incorporated; Federal Highway Administration

Abstract/Synopsis: This report documents the early observations from the Long-Term Pavement Performance (LTPP) Specific Pavement Studies (SPS) conducted as part of the LTPP Program Data Insight, which was conducted to identify initial findings from the test sections established for this program. Comparisons of performance trends were made to evaluate both the distinctions between the various rehabilitation treatments and the performance of the individual treatments themselves based on their condition prior to the treatment. Most of the rehabilitation strategies are still performing adequately after 3 to 4 years of service, as should be expected. Problems have been identified though that can definitely lead to early failures, such as mix design problems and reflective cracking problems. Even at this early point in the life of these rehabilitation strategies, differences in performance can be observed between treatments. With the continued monitoring of these sections, it is anticipated that the pavement community will continue to learn more and more about the performance of the various strategies and the effects of their design factors.

Application/Use: This study is applicable to pavement rehabilitation design.

Contribution: Improvement in Knowledge

Present Benefit: The study is beneficial in documenting early performance differences between the various rehabilitation alternatives conducted at LTPP SPS sites. These early findings can be used to guide future research in rehabilitation techniques and offers state highway officials some insight on initial performance.

Future Benefit: As these LTPP sites continue to deteriorate, additional studies will provide valuable information on performance differences between rehabilitation strategies. Additional findings may be made regarding the effectiveness of various treatments compared with existing pre-rehabilitation conditions.

Title: Study of Maintenance Treatments for Asphalt Pavements

Authors: Morian, D; Gibson, S; Epps, J.

Date: 1997

Publisher: University of Washington, Seattle

Conference Title: Eighth International Conference on Asphalt Pavements

Abstract/Synopsis: During the conduct of the Strategic Highway Research Program (SHRP) on highway operations, flexible and rigid pavement preventive maintenance treatments were placed on pavements in the United States and Canada. The placement and performance monitoring of these Specific Pavement Studies (SPS-3 and SPS-4) have been conducted under the SHRP and Federal Highway Administration (FHWA) Long Term Pavement Performance (LTPP) Program. Field performance reviews of the preventive maintenance treatments have also been conducted by Expert Task Groups (ETG) organized by the Pavement Division of the FHWA. This report summarizes the results of the ETG performance surveys conducted after 5 years of service and the results of the preliminary analysis of LTPP database data for the SPS-3 experiment.

Application/Use: This report can be used by those interested in maintenance alternatives for flexible pavements.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: This study investigates performance differences between various maintenance alternatives, which can be used to determine cost differences based on life cycle cost analysis. Agencies can use this information to determine the most cost-effective treatments along with the proper activity timing.

Future Benefit: Improvements in the efficient selection and timing of maintenance treatments will continue to improve the overall condition of the pavement network at reduced costs.

Title: Rehabilitation of a Jointed Portland Cement Concrete Pavement on I-35 (Southbound) in Kay County, Oklahoma

Authors: Daleiden, J. F; Ooten, D A; Sargent, M. D.

Date: 1995

Publisher: Transportation Research Board

Journal Title: Transportation Research Record No. 1513

Abstract/Synopsis: As part of the SHRP Long Term Pavement Performance (LTPP) Studies, numerous projects are being constructed to study various design strategies for new and rehabilitated pavements. These studies are referred to as Specific Pavement Studies (SPSs). One SPS rehabilitation study specifically targets the rehabilitation of jointed concrete pavements (SPS-6). Specific designs have been prepared and implemented to incorporate seven of the more common concrete pavement rehabilitation strategies, along with a control section. Sixteen such projects are to be constructed around the country. Included in these treatments are asphalt overlays of the jointed concrete both with and without cracking and seating, as well as various other features in an attempt to enhance the performance of these rehabilitation strategies. One of the 16 planned projects was constructed on I-35 in Kay County, Oklahoma, in the fall of 1992. The existing project featured a 0.2-m (8-in.) jointed reinforced concrete pavement, with a 0.1-m (4-in.) sand cushion, over 0.2 m (8 in.) of soil aggregate subbase on a silty clay subgrade. As part of the SHRP LTPP program, performance data have been collected on each test section before and after construction. Although the experimental sections in Oklahoma have not been in service long, distinctions in performance are already apparent. Performance of the sections in Oklahoma appear to indicate that a 0.1-m (4-in.) asphalt overlay of jointed concrete pavement (JCP) can be expected to exhibit reflection cracking within 2 years under typical interstate traffic. Reflective cracking can be controlled to some extent using sawing and sealing of the asphalt cement overlay and can be controlled even more effectively using rubblizing. One must consider, however, that the performance referenced herein may be unique to environment, subgrade type, and traffic levels, to name but a few.

Application/Use: This paper is directly applicable to rehabilitation of concrete pavements in Oklahoma, but can also be used by other agencies interested in the performance of various improvement alternatives.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: SPS-6 projects provide a side-by-side comparison of various rehabilitation alternatives while keeping other factors (such as climate, traffic, and subgrade) constant. The performance data collected at these sites provides sufficient information to quantify the differences between treatments. These differences can be used to optimize alternative selection as well as rehabilitation design.

Future Benefit: The long term performance data collected at SPS projects will allow life-cycle cost analyses to be conducted on the various designs and can be used to optimize

resources. Additionally, the local calibration/validation of the M-E PDG will rely on the LTPP program and, particularly, on the SPS experiments.

Title: Early Analyses of Long-Term Pavement Performance General Pavement Studies Data: Lessons Learned and Recommendations for Future Analyses

Authors: Rauhut, J. B; Simpson, A. L; Daleiden, J. F; Darter, M. I; Owusu-Antwi, E; Pendleton, O. J.

Date: 1994

Publisher: Strategic Highway Research Program

Abstract/Synopsis: The purpose of this report is to share the experience gained and lessons learned by research staff during early data analyses of the General Pavement Studies (GPS) and to recommend procedures for future analysts. A review of the techniques used is provided. Shortcomings of the Long-Term Pavement Performance (LTPP) database, known at the time of early analyses, are discussed and data base expectations for future analyses were identified. Some interesting and useful distress and roughness prediction models were developed that illustrate the effects of several design variables. Other analytical procedures for developing predictive equations were identified and described, which may be of use in future analyses. Ten techniques used by the research staff for evaluating the American Association of Highway and Transportation Officials (AASHTO) design equations are identified and recommendations for future evaluations provided.

Application/Use: Early analysis reports can be used by those interested in early program activities. These reports were also used as internal planning tools.

Contribution: Cost Savings; Lessons Learned; Advancement in Technology.

Present Benefit: Findings from status or summary reports can provide significant insight into the early activities of the program. This information can be used to understand how the program evolved and provides background on the decision process.

Future Benefit: Establishing a national, long-term research program requires significant planning and coordination. Program documentation since the inception of the LTPP program will be extremely beneficial to future data users.

Title: Summary Report - 1993 Field Evaluations of SPS-3 and SPS-4 Test Sites

Authors: Raza, Hassan

Date: 1994

Publisher: Federal Highway Administration

Abstract/Synopsis: This report summarizes findings of nationwide field evaluations of preventive maintenance treatment test sites constructed under the Strategic Highway Research Program's (SHRP) specific pavement studies SPS-3 and SPS-4. The flexible pavement treatments (SPS-3) were crack sealing, chip seals, slurry seals, and thin hot mix overlays. The treatments for rigid pavements (SPS-4) consisted of joint/crack sealing, and undersealing. Studies were conducted to determine the effect of treatments on pavement service life, and to develop information on the optimum timing of the application of various treatments. Field evaluations were conducted in 1993 by members of the Highway Operations Expert Task Group (ETG) as part of FHWA's SHRP implementation efforts. In order to facilitate field evaluations the ETG was divided into four groups, each responsible for one SHRP region. Regional reviews ranged from 7 to 10 days each. A total of 87 test sites were reviewed nationwide. Field observations indicate that pavement sections on which preventive maintenance treatments were applied have generally outperformed the sections that received no treatment. In addition, it was noted that the treatments will be more effective if they are applied before significant deterioration has set in.

Application/Use: Summary reports can be used by those interested in early program activities. These reports were also used as internal planning tools.

Contribution: Cost Savings; Improvement in Knowledge; Advancement in Technology.

Present Benefit: Findings from status or summary reports can provide significant insight into the early activities of the program. This information can be used to understand how the program evolved and provides background on the decision process. This report provides insight into early evaluations of SPS-3 and SPS-4 projects.

Future Benefit: Establishing a national, long-term research program requires significant planning and coordination. Program documentation since the inception of the LTPP program will be extremely beneficial to future endeavors of similar nature. One such example is the Long Term Bridge Performance program, which was recently initiated.

Title: Symposium on PCC Pavement Rehabilitation with HMA Draws National Audience

Date: 1991

Publisher: National Asphalt Pavement Association

Journal Title: HMAT, Hot Mix Asphalt Technology Vol. 6 No. 2

Abstract/Synopsis: The National Symposium on Rehabilitation of PCC Pavements Using Hot Mix Asphalt Overlays (October 1991), in St Louis, Missouri is reviewed. The opening remarks recommended increased cooperation between the private and public sectors in working toward solutions to better roadways. Other presentations covered several aspects of HMA use. The most important presentation was the study on methodologies for rehabilitating PCC (portland cement concrete) pavements which included data on cracking and seating, breaking and seating, and rubblizing PCC pavements followed by HMA overlays. Sawing and seating of HMA overlays on PCC pavements and economic considerations for each were also discussed. Other presentations covered the Strategic Highway Research Program's Long Term Pavement Program (LTPP), including HMA overlays, etc. Progress on the Federal Highway Administration's Project 202, "Break and Seat of Jointed Reinforced Concrete Pavement," was reported. Work on revision of AASHTO's pavement design guide was discussed, as well as guidelines for HMA overlays on PCC pavements and current design procedures.

Application/Use: These proceedings can be used by those interested in concrete pavement rehabilitation.

Contribution: Cost Savings; Improvement in Knowledge.

Present Benefit: The LTPP SPS-6 experiment provides a side-by-side comparison of various rigid pavement rehabilitation alternatives. Direct comparisons can be made between alternatives without confounding information due to traffic, climate, and subgrade variations. This is extremely useful in establishing the most-cost effective strategies for rehabilitation as well as in predicting the pavement's service life after improvements are performed.

Future Benefit: The SPS-6 will continue to provide valuable insight in the performance of rehabilitation strategies and the factors that influence their service life. The SPS-6 projects will also be useful in calibrating the M-E PDG to local conditions.

Title: Condition Surveys in the Strategic Highway Research Program Long-Term Pavement Performance Study and Pavement Condition Rating for Pre-Overlay Conditions (Abridgment)

Authors: Goulias, D. G; Castedo, H; Hudson, W. R.

Date: 1990

Publisher: Transportation Research Board

Journal Title: Transportation Research Record No. 1276

Abstract/Synopsis: The long-term pavement performance (LTPP) research study, a component of the Strategic Highway Research Program (SHRP), represents a $50 million effort to collect field observations of pavement structures from across the United States and Canada. The procedures to be used for rating the condition of LTPP test sections before overlay are discussed. The methods should be used in classifying the condition of a test section as "good" or "bad;" such information is needed as an input variable to the asphalt concrete overlays on asphalt and concrete pavement factorial experiments. These experiments were defined for recruiting in-service test sections for inclusion in the SHRP LTPP study. The distress-monitoring approach being adopted for the long-term monitoring of in-service SHRP pavement sections is then described. The categories and types of distress data to be collected periodically are described, together with uniform and practical distress definitions and monitoring procedures. Finally, information on the contents of survey forms and maps to be used during the process is provided.

Supplemental: This paper appears in Transportation Research Record No. 1276, Maintenance Management 1990: Proceedings of a Workshop, Jackson, Mississippi, July 25-27, 1990.

Application/Use: This paper can be used by those interested in LTPP distress data collection or interested in the methodology of assigning test sections in the experimental matrix for rehabilitation projects.

Contribution: Improvement in Knowledge

Present Benefit: At the beginning of the program, considerable effort was allocated to the development of each experiment design. This paper illustrates how the rehabilitation experiments were categorized. Additionally, the effort in establishing a consistent distress data collection protocol is also documented. The framework and structure of the LTPP program can be applied to many other studies, resulting in reduced start-up costs.

Future Benefit: The LTPP database will continue to be a go-to resource for pavement performance information. As such, background information on experimental design and data collection protocol will continue to benefit the pavement community.