

PAPER 110

Statistical Analysis of LTPP SPS-3 Experiment on Preventive Maintenance of Flexible Pavements

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ABSTRACT

This paper describes the evaluation of preventive treatments in mitigating the rate of distress propagation in flexible pavements. The analysis was based on data from preventive maintenance treatments data collected in the Long Term Pavement Performance (LTPP) program. Data were obtained from 81 sites across the United States and Canada which were part of the specific pavement experiments (SPS-3). SPS-3 was designed to monitor the performance of four treatments: thin overlay, chip seal, crack seal and slurry seal under different design conditions. Design conditions considered were precipitation, temperature, traffic, subgrade materials and pavement condition prior to applying preventive treatment. Fatigue cracking, rutting and longitudinal roughness data collected during the LTPP program were used to compare the overall performance of different treatments. A weighted average index was defined to represent the overall performance of the sections over the years. Statistical techniques were used to compare the effectiveness of each treatment in relation to others and the control section, which did not receive any treatment. Conclusions from the analyses indicated that thin overlay and chip seal are effective treatment options for most design conditions with respect to fatigue cracking. Thin overlay outperforms other treatments in most design conditions with respect to rutting and in some cases with respect to roughness. The difference between the performance of crack seal, slurry seal and control section was not found to be statistically significant with respect to any distress type and design factor.

Maintaining Flexible Pavements The Long Term Pavement Performance Experiment Sps 3 5 Year Data Analysis

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Flexible Pavement Rehabilitation and Maintenance Prithvi S. Kandhal, Mary Stroup-Gardiner, 1998 Papers from a December 1997 symposium detail innovative and effective strategies for rehabilitation and maintenance of existing highways Primary topics addressed include pavement evaluation for rehabilitation and management cold in place recycling techniques for pavement rehabilitation effective **Maintaining Flexible Pavements** D. A. Morian, S. D. Gibson, J. A. Epps, Nichols Consulting Engineers (Firme), États-Unis. Federal Highway Administration. Office of Research and Development, 1999-01-01 Includes introduction and background expert task group field reviews LTPP data base analysis life cycle cost analysis summary conclusions and recommendations Appendices on materials and construction specifications for different parts of the country material properties and test data development and application of a pavement rating score and data on such problems as distress rutting friction and traffic Final appendix is a stand alone report on analysis of asphalt binder properties

Maintaining Flexible Pavements Dennis A. Morian, 1998 **Principles and Practices of Transportation Planning and Engineering** Connie Tang, Lei Zhang, 2021-04-11 Connie Kelly Tang and Lei Zhang have provided a holistic coverage of the entire surface transportation project and program development process from the beginning of planning through environmental approval design right of way acquisition construction to operations and maintenance Neil Pedersen Executive Director Transportation Research Board National Academies of Sciences Engineering and Medicine Washington DC Transportation program and project development is complex The process spans over planning programming environment design right of way construction operations and maintenance Professionals from civil engineering planning social and environmental sciences business and project management and data science work together in a relay team to transform an idea into a highway a transit hub an airport or a water facility It is challenging for any one person to master all the knowledge and skills needed to perform every relevant task However it is critical for all involved to understand how this relay works and how the societal environmental governmental and regulatory contexts influence the process and the technical solution Professionals who understand the process and see the big picture are those who rise to the top as leaders Transportation Project and Program Development provides holistic coverage on the technical subject matter processes and procedures and policy and guidance associated with transportation project and program development which can help professionals become program leaders For each phase of the process key products delivered processes used governing principles foundations of applicable science and engineering technologies deployed and knowledge required are discussed While all coverages reflect the practices of the United States the logic principles science and engineering are applicable to all countries of the world The book can also serve as an introductory textbook for undergraduate students and as a textbook or reference for a graduate level course in civil engineering transportation engineering planning and project management

Introduction to Unmanned Aircraft Systems, Second Edition Douglas M. Marshall, Richard K. Barnhart, Eric

Shappee, Michael Thomas Most, 2015-10-26 The proliferation of technological capability miniaturization and demand for aerial intelligence is pushing unmanned aerial systems UAS into the realm of a multi billion dollar industry This book surveys the UAS landscape from history to future applications It discusses commercial applications integration into the national airspace system NAS System function operational procedures safety concerns and a host of other relevant topics The book is dynamic and well illustrated with separate sections for terminology and web based resources for further information

Preservation Approaches for High-traffic-volume Roadways David G. Peshkin, 2011 TRB's second Strategic Highway Research Program SHRP 2 Report S2 R26 RR 1 Preservation Approaches for High Traffic Volume Roadways documents the state of the practice of preservation treatment on asphalt and concrete pavements on high and low volume roadways The report also includes general guidelines on the application of preservation treatments on high volume roadways The same project that produced SHRP 2 Report S2 R26 RR 1 also produced SHRP 2 Report S2 R26 RR 2 Guidelines for the Preservation of High Traffic Volume Roadways which explores the state of the practice for preservation treatments on high and low volume asphalt and concrete roadways The report also includes suggested guidelines on the application of preservation treatments on high volume roadways *Public Roads*, 1999 LTPP 1998 Year in Review, 1999

Proceedings of GeoShanghai 2018 International Conference: Transportation Geotechnics and Pavement Engineering Xianming Shi, Zhen Liu, Jenny Liu, 2018-05-03 This book is the fourth volume of the proceedings of the 4th GeoShanghai International Conference that was held on May 27-30, 2018 This volume entitled Transportation Geotechnics and Pavement Engineering represents the recent advances and technologies in transportation geotechnics and pavement engineering This book covers a wide range of topics from transportation geotechnics to geomechanics at various length scales to pavement materials and structures The book offers a unique mix of numerical modeling studies experimental studies and case studies from industry It may be of interest to researchers and practitioners in the fields of transportation engineering and pavement engineering Each of the papers included in this book received at least two positive peer reviews The editors would like to express their sincerest appreciation to all of the anonymous reviewers all over the world for their diligent work Impact of Design Features on Pavement Response and Performance in Rehabilitated Flexible and Rigid Pavements, 2011 The primary focus of this research was to determine the effects of design and construction features such as overlay thickness and mix type presence of milling and type of restoration on pavement response and performance and to establish their importance in the prediction of future performances of rehabilitated pavements Long Term Pavement Performance program Specific Pavement Study SPS 5 and SPS 6 experiments provided information to obtain a better understanding of the effects of design and construction features on pavement response and performance of rehabilitated flexible and rigid pavements Guidelines for the Preservation of High-traffic-volume Roadways David G. Peshkin, 2011 TRB's second Strategic Highway Research Program SHRP 2 Report S2 R26 RR 2 Guidelines for the Preservation of High Traffic

Volume Roadways explores the state of the practice for preservation treatments on high and low volume asphalt and concrete roadways The report also includes suggested guidelines on the application of preservation treatments on high volume roadways *Capital Preventive Maintenance*, 2004 *Long-term Pavement Performance Program (LTPP) Data Analysis Support* N. Jackson, Jason Puccinelli, 2006 **The Use of Reliability Analysis for Determining the Life Expectancy of Preventive Maintenance Fixes in Asphalt Surfaced Pavements** Jason Paul Bausano, 2003 *Data Analysis in Pavement Engineering* Qiao Dong, Xueqin Chen, Baoshan Huang, 2023-11-06 Data Analysis in Pavement Engineering Theory and Methodology offers a complete introduction to the basis of the finite element method covering fundamental theory and worked examples in the detail required for readers to apply the knowledge to their own engineering problems and understand more advanced applications This edition sees the significant addition of content addressing coupling problems including Finite element analysis formulations for coupled problems Details of algorithms for solving coupled problems and Examples showing how algorithms can be used to solve for piezoelectricity and poroelasticity problems Focusing on the core knowledge mathematical and analytical tools needed for successful application this book represents the authoritative resource of choice for graduate level students researchers and professional engineers involved in finite element based engineering analysis This book is the first comprehensive resource to cover all potential scenarios of data analysis in pavement and transportation infrastructure research including areas such as materials testing performance modeling distress detection and pavement evaluation It provides coverage of significance tests design of experiments data mining data modeling and supervised and unsupervised machine learning techniques It summarizes the latest research in data analysis within pavement engineering encompassing over 300 research papers It delves into the fundamental concepts elements and parameters of data analysis empowering pavement engineers to undertake tasks typically reserved for statisticians and data scientists The book presents 21 step by step case studies showcasing the application of the data analysis method to address various problems in pavement engineering and draw meaningful conclusions **The Use of Long Term Pavement Performance Data for Quantifying the Relative Effects of Structural and Environmental Factors on the Response and Performance of New Flexible Pavements** Syed Waqar Haider, 2005 *Transportation Research Record*, 2004

Highway Research Institution of Civil Engineers (Great Britain), 1991 The level of research activity in the highway sector as a whole has declined precipitously in recent decades whilst the challenges facing US state highway agencies have escalated As a result a Strategic Highway Research Program SHRP was initiated to establish collaboration with research bodies tackling similar highway problems in countries worldwide This collection of reports from around the world presents SHRP s progress towards providing research based new products from which the international highway engineering community may benefit SHRP concentrates on six high priority research areas asphaltic materials pavement performance cement and concrete maintenance cost effectiveness concrete bridge component protection systems and the chemical control

of snow and ice **14th International Conference on Asphalt Pavements ISAP2024 Montreal** Alan Carter, Kamilla Vasconcelos, Eshan Dave, 2024-12-23 The conference proceeding presents state of the art papers related to asphalt materials and asphalt pavements The different thematic areas of the conference are Accelerated pavement testing Advanced Pavement Materials and Technologies Effect of environmental changes on materials properties In situ property evaluation using non destructive techniques Instrumentation and monitoring of asphalt pavements Interaction of the material with the environment during production construction use and demolition Life cycle analysis LCA in asphalt pavements Numerical modeling of materials and pavement structures Pavement Management System Pavement roughness and friction measurement Pavement sustainability Performance testing and performance based specifications Perpetual pavements and Recycling and Use of marginal materials in asphalt **SHRP-LTPP Overview** William O. Hadley, 1994 This report provides an overview of the first 5 years of the Strategic Highway Research Program Long Term Pavement Performance SHRP LTPP program The background LTPP history activities and approaches and decision making processes of the program are detailed Included are summaries of the studies initiated for general and specific pavement types the characterization of pavement materials monitoring activities the LTPP database and Information Management System data analysis traffic data collection and analysis as well as a summary of the contributions made by international participants The general LTPP program is described and the expected results products and benefits are also outlined

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