



University Transportation Research Center - Region 2

Final Report

Effectiveness-Based Pavement Preservation Selection Based on Statistical Analysis of Long Term Pavement Performance Data

Performing Organization: Rutgers University

June 2014



Sponsor(s):
University Transportation Research Center - Region 2

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The Region 2 University Transportation Research Center (UTRC) is one of ten original University Transportation Centers established in 1987 by the U.S. Congress. These Centers were established with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. University faculty members provide a critical link in resolving our national and regional transportation problems while training the professionals who address our transportation systems and their customers on a daily basis.

The UTRC was established in order to support research, education and the transfer of technology in the field of transportation. The theme of the Center is "Planning and Managing Regional Transportation Systems in a Changing World." Presently, under the direction of Dr. Camille Kamga, the UTRC represents USDOT Region II, including New York, New Jersey, Puerto Rico and the U.S. Virgin Islands. Functioning as a consortium of twelve major Universities throughout the region, UTRC is located at the CUNY Institute for Transportation Systems at The City College of New York, the lead institution of the consortium. The Center, through its consortium, an Agency-Industry Council and its Director and Staff, supports research, education, and technology transfer under its theme. UTRC's three main goals are:

Research

The research program objectives are (1) to develop a theme based transportation research program that is responsive to the needs of regional transportation organizations and stakeholders, and (2) to conduct that program in cooperation with the partners. The program includes both studies that are identified with research partners of projects targeted to the theme, and targeted, short-term projects. The program develops competitive proposals, which are evaluated to insure the most responsive UTRC team conducts the work. The research program is responsive to the UTRC theme: "Planning and Managing Regional Transportation Systems in a Changing World." The complex transportation system of transit and infrastructure, and the rapidly changing environment impacts the nation's largest city and metropolitan area. The New York/New Jersey Metropolitan has over 19 million people, 600,000 businesses and 9 million workers. The Region's intermodal and multimodal systems must serve all customers and stakeholders within the region and globally. Under the current grant, the new research projects and the ongoing research projects concentrate the program efforts on the categories of Transportation Systems Performance and Information Infrastructure to provide needed services to the New Jersey Department of Transportation, New York City Department of Transportation, New York Metropolitan Transportation Council, New York State Department of Transportation, and the New York State Energy and Research Development Authority and others, all while enhancing the center's theme.

Education and Workforce Development

The modern professional must combine the technical skills of engineering and planning with knowledge of economics, environmental science, management, finance, and law as well as negotiation skills, psychology and sociology. And, she/he must be computer literate, wired to the web, and knowledgeable about advances in information technology. UTRC's education and training efforts provide a multidisciplinary program of course work and experiential learning to train students and provide advanced training or retraining of practitioners to plan and manage regional transportation systems. UTRC must meet the need to educate the undergraduate and graduate student with a foundation of transportation fundamentals that allows for solving complex problems in a world much more dynamic than even a decade ago. Simultaneously, the demand for continuing education is growing – either because of professional license requirements or because the workplace demands it – and provides the opportunity to combine State of Practice education with tailored ways of delivering content.

Technology Transfer

UTRC's Technology Transfer Program goes beyond what might be considered "traditional" technology transfer activities. Its main objectives are (1) to increase the awareness and level of information concerning transportation issues facing Region 2; (2) to improve the knowledge base and approach to problem solving of the region's transportation workforce, from those operating the systems to those at the most senior level of managing the system; and by doing so, to improve the overall professional capability of the transportation workforce; (3) to stimulate discussion and debate concerning the integration of new technologies into our culture, our work and our transportation systems; (4) to provide the more traditional but extremely important job of disseminating research and project reports, studies, analysis and use of tools to the education, research and practicing community both nationally and internationally; and (5) to provide unbiased information and testimony to decision-makers concerning regional transportation issues consistent with the UTRC theme.

Project Completion Date: June 2014

Project Title: Effectiveness-Based Pavement Preservation Selection Based on Statistical Analysis of Long Term Pavement Performance Data

Project's Website:

<http://www.utrc2.org/research/projects/pavement-preservation-selection>

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Performing Organizations: Rutgers University

Sponsors:

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16. Abstract This study compared the effectiveness of preservation treatments on pavement surface friction and investigated the long-term variation of friction using the data collected in the Specific Pavement Studies-3 (SPS-3) of the Long Term Pavement Performance (LTPP) program. The SPS-3 focuses on the effect of four preservation treatments (thin overlay, chip seal, crack seal, and slurry seal) on pavement performance under five design factors (traffic, precipitation, temperature, existing pavement condition, and subgrade type). Both the simple ranking method and statistical methods (boxplot and Fisher's Least Significance Difference test) were used to compare the effectiveness of preservation treatments on friction improvement. The statistical analysis results indicate that slurry seal causes significantly greater friction number compared to the control section; and the ranking from high to low based on the average friction number among four preservation treatments is: slurry seal, chip seal, thin overlay and crack seal. Among the five design factors, subgrade type and existing pavement condition show less influence on pavement friction compared to climate and traffic factors. Stepwise regression analysis was conducted to quantify the influence of various factors (material, traffic, temperature, precipitation, and freezing index) on the long-term variation of pavement friction within the monitoring period. It was found that the application rate of slurry seal and chip seal affected the friction variation and temperature showed negative correlation with friction. In addition, pavement roughness was found having certain correlation with friction for the control sections and the sections with crack seal.					
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PROJECT TITLE: EFFECTIVENESS-BASED PAVEMENT PRESERVATION SELECTION BASED ON STATISTICAL ANALYSIS OF LONG TERM PAVEMENT PERFORMANCE DATA

PRINCIPAL INVESTIGATOR: DR. HAO WANG

INSTITUTION: RUTGERS UNIVERSITY

COMPLETION DATE: JUNE 30, 2014

SPONSOR: UNIVERSITY TRANSPORTATION RESEARCH CENTER (UTRC)

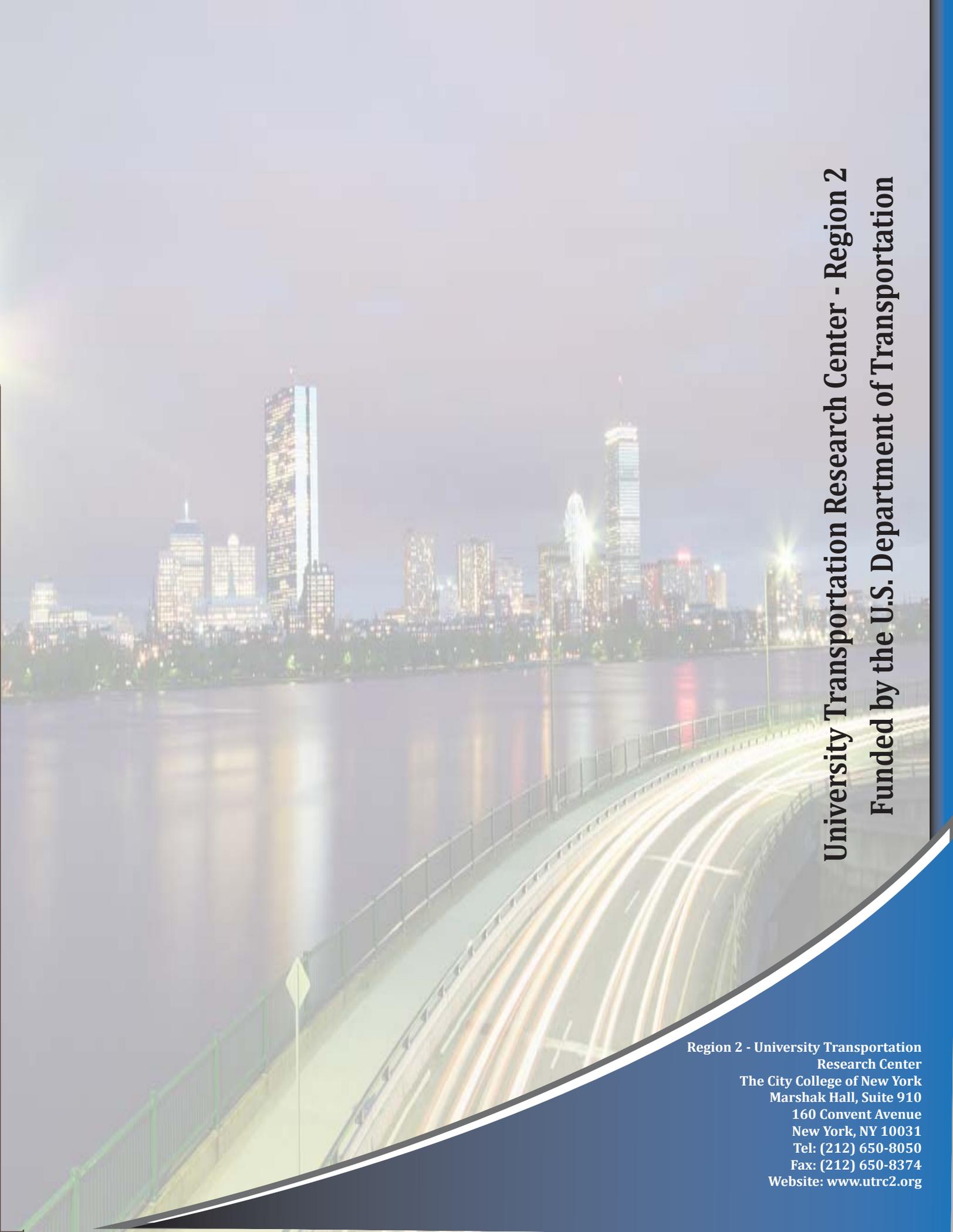
Pavement preservation can retard development of pavement distresses and improve pavement function performance. Quantification of the effectiveness of preservation has important implications for the selection of pavement maintenance strategies and decision making in pavement management system. Most of previous studies mainly focused on the effectiveness of preservation on pavement serviceability index (PCI) and roughness; few studies considered the effectiveness of preservation on individual pavement distress and safety performance. The objective of this study is to investigate the effectiveness of pavement preservation on mitigating different asphalt pavement distresses and restoring pavement surface friction using the extracted data from the Long Term Pavement Performance (LTPP) program and advanced statistical analysis methods. It is expected that the analysis results can aid state and municipal agencies better select the appropriate maintenance treatments to maximize the cost effectiveness of pavement preservation and increase the longevity of transportation infrastructure.

In particular, this study compared the effectiveness of preservation treatments on pavement surface friction. The LTPP SPS-3 focuses on the effect of four preservation treatments (thin overlay, chip seal, crack seal, and slurry seal) on pavement performance under five design factors (traffic, precipitation, temperature, existing pavement condition, and subgrade type). Both the simple ranking method and statistical methods (boxplot and Fisher's Least Significance Difference test) were used to compare the effectiveness of preservation treatments on friction improvement.

The statistical analysis results indicate that slurry seal causes significantly greater friction number compared to the control section; and the ranking from high to low based on the average friction number among four preservation treatments is: slurry seal, chip seal, thin overlay and crack seal. Among the five design factors, subgrade type and existing pavement condition show less influence on pavement friction compared to climate and traffic factors.

Stepwise regression analysis was conducted to quantify the influence of various factors (material, traffic, temperature, precipitation, and freezing index) on the long-term variation of pavement friction within the monitoring period. It was found that the application rate of slurry seal and chip seal affected the friction variation and temperature showed negative correlation with friction. In addition, pavement roughness was found having certain correlation with friction for the control sections and the sections with crack seal.

Link: [HTTP://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/PII/S0950061813005667](http://www.sciencedirect.com/science/article/pii/S0950061813005667)

A long-exposure photograph of a city skyline at night, reflected in a body of water. In the foreground, a bridge or highway has light trails from moving vehicles. The sky is dark, and the city lights are bright and colorful.

University Transportation Research Center - Region 2
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