IMPACTS OF DESIGN FACTORS, MAINTENANCE AND REHABILITATION TREATMENTS ON PAVEMENT CONDITION AND DISTRESS USING THE LTPP TEST SECTIONS

By

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ABSTRACT

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Pavement sections are typically subjected to a series of several maintenance and rehabilitation treatments over the lifetime of the pavement to restore conditions and prevent deterioration. A knowledge gap exists between treatment strategy selection and the estimation of treatment effectiveness and condition forecasting. Several pavement treatments have been applied to the test sections of the LTPP experiments SPS-1 through SPS-7 and GPS-6, -7 and -9. In this study sponsored by the Federal Highway Administration (FHWA), the time series pavement condition and distress data of such LTPP test sections and test sections in the States of Washington, Louisiana, and Colorado, where several pavement treatments have been applied were analyzed and the effectiveness of each treatment and each series of treatments were quantified. Treatments effectiveness were studied in terms of several metrics such as immediate change in functional/structural period (CFP/CSP), functional/structural condition reoccurrence period (FCROP/SCROP), and remaining functional/structural period (RFP/RSP). Based on a synthesis of the results, recommendations were made for pavement managers to better perform LCCA and for future research.

TO MOM, DAD, & MONA

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CHAPTER 1

INTRODUCTION

1.1 Background

The U.S. highway system is a key part of the economy, market competitiveness, and defense of the nation. The design and construction of the U.S. interstate highway network was launched by Congress in 1956 and was essentially completed in 1992. More than halfway during the construction period, there were key concerns about the deterioration of highways that were already built. It was deemed that a huge reinvestment was required to maintain, rehabilitate, and operate the existing network. Despite the huge expenditures, there were no comprehensive research studies conducted since the AASHO Road Test (a large-scale accelerated field experiment conducted under one set of climate and soil conditions) in 1960. The effects of climatic regions, maintenance practices, long-term loads, material variations, and construction practices on pavement performance were unclear and hence a long-term study of a large number of actual field conditions was required. (Hadley, 1994).

The Strategic Transportation Research Study (STRS) conducted in 1983 documented the small percentage of research expenditures in the highway industry and the yearly decline in research spending. The study has identified six areas in which concentrated research efforts could dramatically reduce expenditures for design, construction, maintenance, and rehabilitation of highway systems. These areas were asphalt, maintenance cost-effectiveness, protection of concrete bridge components, cement concrete in highway structures, control of snow and ice on highways, and long-term pavement performance. (Hadley, 1994). In each area, priorities were established for these problem areas for which major innovations would increase the productivity, effectiveness, and safe operation of the nation's highway system.

During 1984-86, the American Association of State Highway and Transportation Officials (AASHTO), Federal Highway Administration (FHWA), the Transportation Research Board (TRB), and the National Research Council (NRC) supported a study to develop research plans for the six strategic problem areas, with particular emphasis on long-term pavement performance. As a result, the Strategic Highway Research Program (SHRP) was established as an independent unit of the National Research Council and became fully operational in April 1987. The 6 STRS research areas were combined into the following SHRP research programs:

- Asphalt
- Highway Operations
- Concrete and Structures
- Long-Term Pavement Performance (LTPP)

So, the LTPP program was established under the guidance of SHRP in 1987 for the first 5 years. FHWA has undertaken the LTPP program since 1991 managed it since then. The LTPP program monitors and collects various data at more the 2500 asphalt and Portland concrete cement (PCC) pavement sections throughout the United States and Canada. Since 1999, the national level analysis of the LTPP data has been guided by the "Strategic Plan for Long-Term Pavement Performance Data Analysis." The Strategic Plan was developed by the TRB Expert Task Group on LTPP Data Analysis. This plan has been recommended by the TRB LTPP Committee and adopted by FHWA as the basis for selecting LTPP analysis projects and evaluating progress in LTPP data analysis. The plan sets forth the following strategic objectives:

- Improve traffic characterization and prediction
- Improve materials characterization
- Determination of environmental effects in pavement design and performance prediction

- Evaluation and use of pavement condition data in pavement management
- Development of pavement response and performance models applicable to pavement design and performance prediction
- Maintenance and rehabilitation strategy selection and performance prediction
- Quantification of the performance impact of specific design features
- Analyses supporting and enhancing the use of the ME- PDG
- Comprehensive use of LTPP to improve the management of pavement assets

1.2 Problem Statement

Pavement sections are typically subjected to a series of several maintenance and rehabilitation treatments over the lifetime of the pavement to restore conditions and prevent deterioration. Several research studies have been undertaken to investigate the effectiveness of single pavement treatment, while some have developed complex life-cyc1e cost analysis (LCCA) tools. Yet, a knowledge gap exists between treatment strategy selection and the estimation of treatment effectiveness and condition forecasting. Several pavement treatments have been applied to the test sections of the LTPP experiments SPS-1 through SPS-7 and GPS-6, -7 and -9. In this study, the time series pavement condition and distress data of such test sections where several pavement treatments have been applied shall be analyzed and the effectiveness of each treatment and each series of treatments shall be quantified. Treatment effectiveness shall be studied in terms of several metrics such as immediate change in functional/structural period (CFP/CSP), functional/structural condition reoccurrence period (FCROP/SCROP), and remaining functional/structural period (RFP/RSP). Based on a synthesis of the results, recommendations shall be formulated for pavement managers to better perform LCCA and for future research.

1.3 Objectives of this Study

The objectives of this study are:

- Define the pavement performance in a way that supports the selection of cost-effective pavement treatment strategy.
- Provide better estimates of pavement treatment effectiveness and the role of pavement treatments in the pavement's service life cycle.
- Develop pavement performance prediction methodologies that are applicable to the pavement condition and distress data collected before and after the application of treatments or series of treatments.
- Make recommendations for subsequent studies regarding the impacts and/or selection of pavement maintenance, preservation, and rehabilitation treatment options and strategies and their impacts on the pavement service life.

1.4 Research Plan

To accomplish the objectives, a research plan consisting of four tasks was designed. These tasks are presented below.

Task 1 – Literature Review

In this task, extensive literature review of published performance measures from state highway agencies (SHAs), FHWA, National Cooperative Highway Research Council (NCHRP), and other countries (such as Australia, Canada, and Europe) were conducted. The review was focused on the following topics:

1. Definitions and methodologies used to determine good, fair, and poor pavement conditions.
2. Efficiency of the various pavement maintenance and rehabilitation treatments and their predicted and measured performance.

3. Selection of pavement preservation and rehabilitation strategy and their impacts on long life pavements.
4. Advantages and shortcomings of the remaining service life (RSL) and remaining service interval (RSI) of various pavement sections.

Task 2- Pavement Condition Classification System

Pavement condition classification systems were developed. One system consists of three condition states (CSs) and the other on 5 CSs. Each system classify the pavement based on its functional and structural conditions. The functional classification is based on ride quality (IRI) and safety (rut depth) and is expressed by the remaining functional period (RFP). The structural rating is based on cracking and rut depth or faulting, and is expressed by the remaining structural period (RSP). The RFP and RSP are a dual rating system that can be considered as a pavement rating for the users, and for the agency, respectively.

Task 3 – Data Extraction/Mining and Synthesis

The data required for the analyses were extracted from the standard release 28 of the LTPP database. The data includes inventory, pavement condition, and treatment type and timing of all pavement test sections of the experiments SPS-1 through SPS-7 and GPS-6,-7 and -9. Majority of the test sections in these experiments have been subjected to one or more treatments. The time series pavement condition (IRI) and distress (fatigue cracking, transverse cracking, longitudinal cracking, and rut depth) data were extracted and organized in a Microsoft Excel spreadsheet format for analyses. In addition, time series pavement condition and distress data from the states of Colorado, Louisiana, and Washington were used to show that results of the study apply equally to the LTPP and state data.

Task 4 – Data Analyses & Evaluation – Performance Classification

For each pavement test section in SPS-1 through SPS-7 and GPS-6,-7, and -9, and for each pavement condition and distress type, the time dependent data were separated to two categories; before treatment (BT) and after treatment (AT). The data were then modeled using the appropriate mathematical functions to estimate the:

- Pavement rates of deterioration BT and AT.
- Remaining functional and structural periods BT and AT using pre specified threshold values.
- The treatment benefits in terms of the change in functional and structural periods. The change in functional and structural periods can be calculated as the differences between the RFP or RSP before and after treatment.
- The time period for the re-occurrence of the BT pavement conditions and distress.
- The immediate change in the pavement conditions and distresses. The results represent the instantaneous user benefits and the datum for pavement performance after treatment.

Results of the analyses were also grouped per pavement type, treatment type, pavement condition and distress type, and environmental region. The grouped data were then scrutinized to determine were used to determine:

- The impacts of each treatment type on each pavement performance measure.
- The average benefits and, perhaps, the benefits of each treatment relative to each pavement condition and distress type.
- The effectiveness of each treatment were evaluated and referenced based on the BT conditions.
- The impacts of the environment, design, and site factors on the benefits of each treatment.

The findings were summarized and presented in the varfious Chapters of this thesis.

1.5 Thesis Layout

This thesis is composed of the eight chapters and seven appendices listed below.

Chapter 1 – Introduction

Chapter 2 – Literature Review

Chapter 3 – Pavement Condition Classification System

Chapter 4 – Data Mining and Synthesis

Chapter 5 – LTPP Data Analyses of Flexible Pavements

Chapter 6 – LTPP Data Analyses of Rigid Pavements

Chapter 7 – State Data Analyses

Chapter 8 – Summary, Conclusions, and Recommendations

References

Appendix A – Inventory of Automated and Manual Surveys

Appendix B – Summary of the LTPP Data

Appendix C – Data and Treatment Lists

Appendix D – SPS-1 Analyses

Appendix E - SPS-3 Analyses

Appendix F – SPS-2 Analyses

Appendix G – State T^2M

CHAPTER 2

LITERATURE REVIEW

An extensive literature review was conducted in support of this research study. The review focused on various topics including:

- Definitions and methodologies used to determine good, fair, and poor pavement conditions.
- Effectiveness of the various pavement maintenance and rehabilitation treatments and their predicted and measured performance.
- Selection of pavement preservation and rehabilitation strategies and their impacts on the pavement service life.
- Advantages and shortcomings of pavement treatment benefits, including the remaining service life (RSL) concept.
- LTPP experimental design and the in-place pavement sections (included in Chapter 3).
- Research findings from previous studies of the LTPP data (included in Chapter 3).

2.1 Pavement Distress Severity Levels

The LTPP and the majority of SHA pavement distress data are collected based on three severity levels; low, medium, and high. The distress severity rating can be problematic because it is a function of the judgment of the surveyor who is observing the pavement or, in the case of many SHAs, is reviewing and digitizing the electronic pavement surface images. Such judgment is a function of the degree of training and experience of the surveyors. Further, the same pavement segment may not be reviewed by the same surveyor each year or each data collection cycle. In addition, the crack severity level is a function of the crack opening, which is a function of the pavement temperature at the time of data collection. Thus, a crack may be labeled high severity in one year and medium the next year or vice versa. Figures 2.1 and 2.2 depict an example of

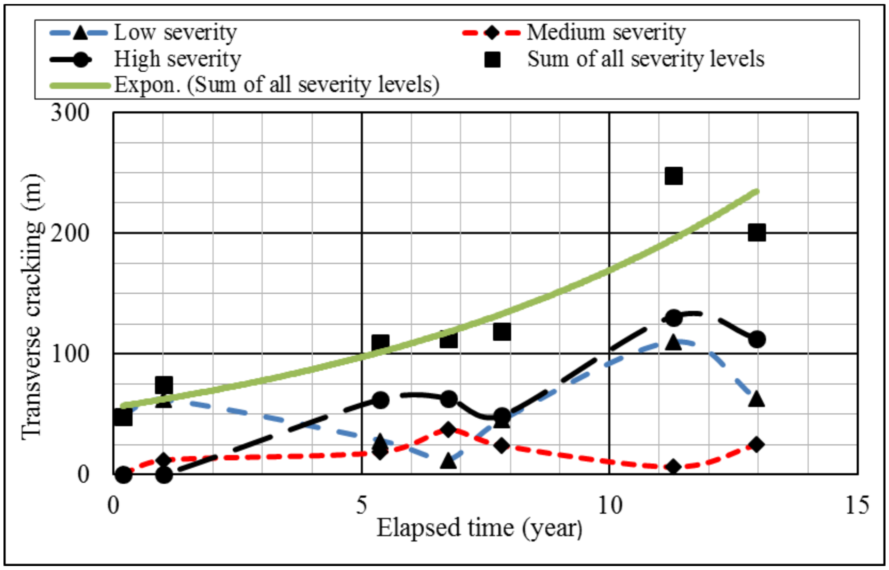


Figure 2.1 Time series transverse cracking data for each severity level and the sum of all severity levels, SPS-3 test section A330, state of California

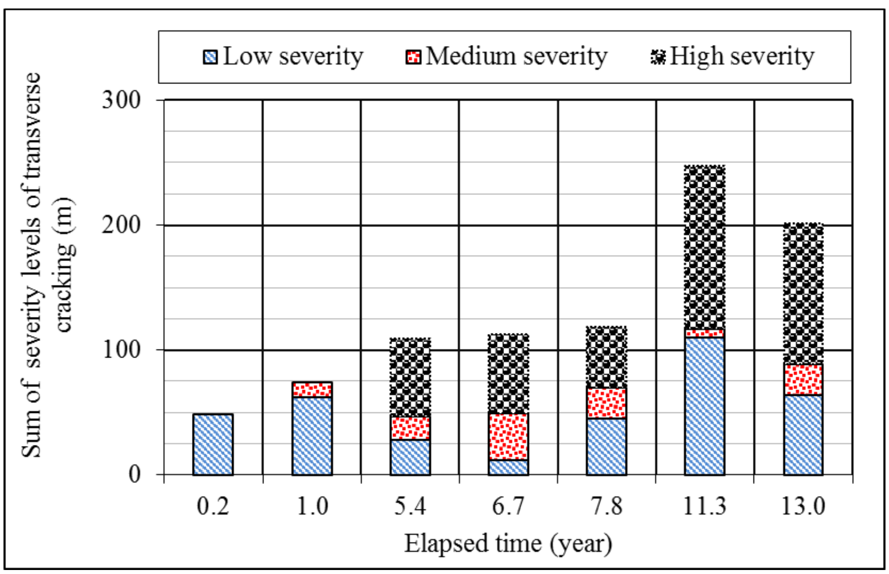


Figure 2.2 Cumulative time series transverse cracking data showing individual transverse crack severity level and the sum of all severity levels, SPS-3 test section A330, state of California

the time series data for each transverse crack severity level for LTPP test section A330 of the SPS-3 experiment in California. The two figures indicate that:

1. The length of transverse cracks in any given severity level changes from one year to the next without the application of any pavement treatment. To illustrate, the length of low severity transverse crack in Figure 2.1 is about 60 meters in year one, 25 meters in year five, 15 meters in year seven, more than 100 meters in year eleven, and 60 meters in year thirteen. The medium severity crack length is approximately 10 meters in year one, 40 meters in year seven, only about 5 meters in year eleven, and increases to about 25 meters in year thirteen. Finally, the length of the high severity transverse cracks is about 70 meters in year six, 50 meters in year eight, 130 meters in year eleven, and 115 meters in year thirteen.

   The variability of the crack lengths of the three severity levels could be attributed to two reasons:

   a) The pavement temperature at the time of data collection. Higher temperature causes the crack width to decrease resulting in an observed change in severity level. This problem cannot be addressed unless the pavement temperature is measured during the survey and an accurate temperature dependent crack width model is developed. Note that the LTPP surveyors do collect pavement temperature data during survey and most SHA only collect temperature data on a limited basis.
   b) The pavement surveyor judges and labels some cracks as low severity in one year and medium or high severity in other years. This inconsistency could be addressed through computerized crack rating quality control and/or enhanced observer training.

2. The high variability of the individual severity levels does not allow accurate modeling of the crack propagation over time. In fact, the data indicate that the medium and high severity

transverse crack lengths are decreasing then increasing over time without any pavement treatment. A previous study sponsored by the Federal Highway Administration (FHWA) (Baladi et al. 2009) expressed the pavement cracking data as the sum of the three severity levels. This yielded much less data variability as evidenced by the exponential model of the total transverse crack length shown in Figure 2.1.

The crack severity level data could be used to roughly estimate the amount of work to be done. For example, cracks in the medium and high severity levels need to be sealed or patched. Low severity cracks are typically not sealed or patched. For rigid pavements, low severity transverse cracks may be subjected to dowel bar retrofit, while medium and high severity cracks are typically not (Dawson 2012). Similar patterns can be found in the SHAs cracking data as shown in Figures 2.3 and 2.4 along a portion of Highway 24 in Colorado.

2.2 Engineering Thresholds (Criteria)

Some SHAs express pavement conditions and distresses using one or more of the following methods (see Figure 2.5 and 2.6) (Baladi et al. 1992, Dawson et al. 2011):

1. A descriptive scale, such as very good, good, fair, poor, and very poor.
2. A distress index based on a continuous rating scale (i.e., zero to ten or zero to one hundred). One end of the scale defines “failed” pavement and the other “excellent” pavement (such as a new pavement) as shown in Figure 2.5. Some SHAs calculate one distress index for each type of distress (that is individual distress indices) while others use a composite pavement index.
3. Along the rating scale, one or more threshold values are typically established to flag pavement sections for possible treatment actions. Depending on the functionality of the

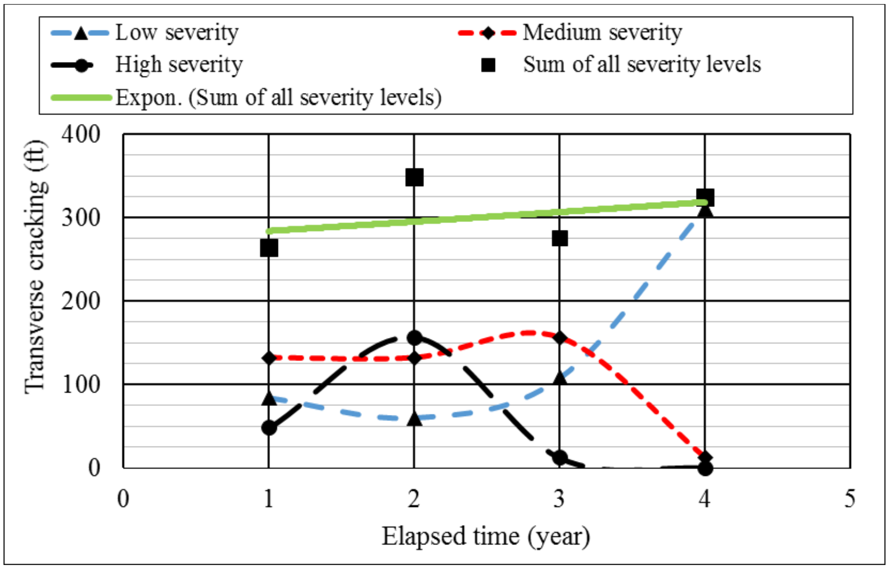


Figure 2.3 Time series transverse cracking data for each severity level and the sum of all severity levels, HWY 24, direction 2, BMP 329.9, state of Colorado

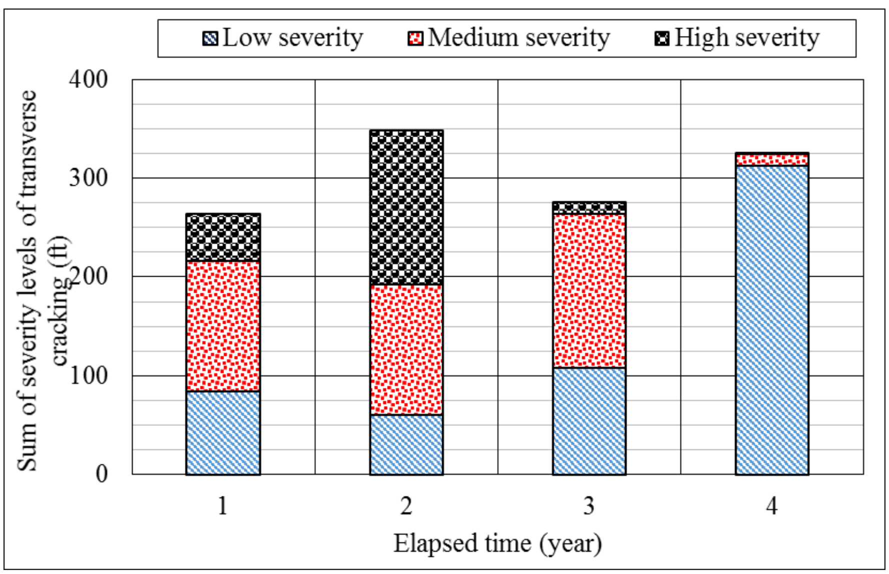


Figure 2.4 Cumulative time series transverse cracking data showing individual transverse crack severity and sum of all severity levels, HWY 24, direction 2, BMP 329.9, state of Colorado

Deduct distress points rating scale with a threshold value of 60 points
(100 = Excellent pavement)

0	10	20	30	40	50	60	70	80	90	100

Very poor	Poor	Fair	Good	Very good

Descriptive scale

Engineering criterion = maximum acceptable number of cracks = 50 transverse cracks per 0.1 mile long pavement segment, which is equivalent to 1 crack every 10.5 feet and correspond to 60 points on the rating scale

Deduct value method

Distress points per transverse crack = DP/TC

$$\text{DP/TC} = \frac{(\text{maximum rating scale value} - \text{threshold value})}{\text{Maximum acceptable number of transverse cracks}} = \frac{(100-60)}{50} = 0.8$$

Distress points = DP = 100 - (0.8)(the number of TC)

Cumulative distress points rating scale with a threshold value of 40 points
(0.0 = Excellent pavement)

0	10	20	30	40	50	60	70	80	90	100

Very good	Good	Fair	Poor	Very poor

Descriptive scale

Cumulative distress points

Distress points per transverse crack = DP/TC

$$\text{DP/TC} = \frac{(\text{Threshold value})}{\text{Maximum acceptable number of transverse cracks}} = \frac{40}{50} = 0.8$$

Distress points = DP = (0.8)(the number of TC)

Figure 2.5 Rating and descriptive scales and distress points

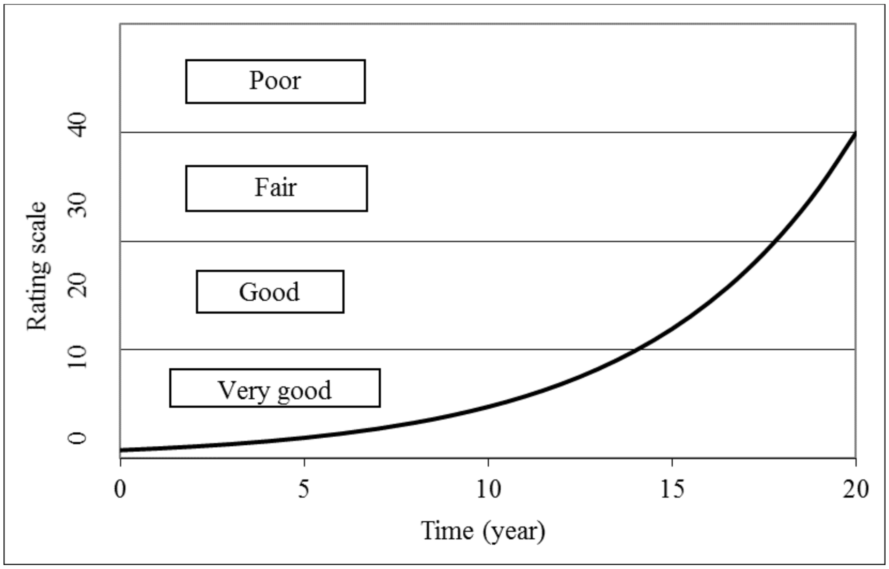


Figure 2.6 Descriptive regions of rating scales or pavement condition (Dawson et al. 2011)

threshold value (maintenance, preservation, or rehabilitation), a distress index value below the established threshold value indicates the need to either maintain, preserve, or rehabilitate the pavement section in question. The rehabilitation threshold value typically separates acceptable from non-acceptable pavement conditions.

It is important to note that if the threshold value is established based on engineering criteria; the pavement condition rating will be such that the relative condition of the pavement segment is constant for a given condition. The engineering criterion should be selected based on the experience of the highway agency and should address the extent of the condition or distress at which the pavement section in question is deemed in need of repair within the constraints of the agency. An example of engineering criterion for transverse cracking could be 50 transverse cracks (crack spacing of about 10.5 feet along a 0.1 mile long asphalt pavement segment). Based on the engineering criterion, distress points can be assigned to each occurrence of the distress (each transverse crack) and the rating scale threshold value. To illustrate, consider the continuous rating scale of 0.0 to 100.0 (100 indicates no transverse cracks) and its threshold value of 60 points shown in Figure 2.5. An engineering criterion of 50 transverse cracks per 0.1 mile implies that the asphalt pavement score is 60 (it loses 40 distress points) when the pavement segment accumulates 50 transverse cracks. Based on a linear accumulation of distress points, each transverse crack is worth 0.8 distress points (after Baladi et al. 1992). If the agency decided to change the threshold value from 40 to 50 but to maintain the engineering criterion of 50 transverse cracks, then 50 cracks will cause the pavement section to lose 50 distress points and each crack is worth one distress point. Stated differently, the engineering criteria for establishing the threshold values should be based on the extent of the distress rather than a number on the rating scale.

Finally, the engineering criteria express the conditions of the pavement and could be based on the user or the agency. Examples of roadway user based criteria are ride quality (International Roughness Index, IRI) and rut depth. Examples of agency based criteria are cracking and faulting. One other note is that the engineering criteria for certain distress or condition types could be global or could be established based on pavement class, traffic volume, regional needs, and so forth. Nevertheless, the methods used to develop the engineering criteria should be well documented and the criteria should be studied and calibrated as more pavement condition and distress data become available.

Many SHAs such as the Louisiana Department of Transportation and Development (LADOTD), the Colorado Department of Transportation (CDOT), the Michigan Department of Transportation (MDOT), and the Washington State Department of Transportation (WSDOT) have developed engineering criterion for each distress type and severity level. Examples of such criteria for alligator cracking and the associated deduct points are listed in Table 2.1 (Khattak & Baladi 2007).

Table 2.1 Engineering criteria and deduct points for alligator cracking (Khattak & Baladi 2007)

Alligator cracking deduct points						
Severity	Extent (ft^2)					
	0-51	51-701	701-1301	1301-2401	2401-3168	> 3168
Low	0	1-16	16-21	21-25	25-28	28
Medium	0	1-21	21-29	29-36	36-49	48
High	0	1-29	29-43	43-50	43-61	61

2.3 Pavement Distress and Condition Indices

Pavement distress indices are often based on one or more condition or distress types. For example, alligator cracking index (an individual index) is based on the severity levels (low, medium, and high) and extent of the alligator cracks. Whereas, a combined pavement distress index (such as pavement condition index, PCI) consists of two or more condition or distress types. The combined index expresses the sum of the distress points assigned to each distress type and severity level divided by the number of pavement segments (Equation 2.1). Hence, a combined pavement distress index expresses the average pavement condition and not the actual condition based on individual distress types (Baladi et al. 1992, Baladi et al. 1999).

$$DI = \frac{\sum DP}{N} = \left(\frac{0.1}{L}\right)\left(\sum DP\right) \qquad \text{Equation 2.1}$$

Where, DI is a distress index;

$\sum$ DP is the sum of the distress points along the project;

N is the number of 0.1-mile long segments along the project (N = L/0.1); and

L is the project length in miles.

Finally, the distress points or the pavement condition indices do not express the true nature of the pavement conditions. For example, immediately after construction, the cumulative distress points of a pavement project subjected to a 2-inch asphalt overlay are exactly the same as the cumulative distress points for another project subjected to a 6-inch asphalt overlay. The pavement surface conditions of both projects are free of distresses. Stated differently, neither the distress points nor the condition indices express the design life of the overlay or the impact of the type of pavement preservation or rehabilitation on the pavement service life. Further, the differences between the distress points and the pavement distress index before and after treatment cannot and should not be used to express the benefits of the applied pavement maintenance or rehabilitation treatments. Consider three pavement sections having the same distress points and distress index that were subjected to 2, 4, and 6-inch asphalt overlays, respectively. The differences in the distress points and distress index before and after treatment are exactly the same although the costs of the overlays are substantially different and so are their design lives and future pavement performance. The design life of the treatment and the pavement rate of deterioration must be accounted for in the calculation of the true benefits of the treatments (Baladi et al. 2009).

2.4 Descriptive Pavement Conditions (Good, Fair, and Poor)

Descriptive terms (such as good, fair, and poor) are also used to express the various categories of the pavement conditions. Although the terms hide important details, they are universal and easily communicated to legislators and the general public. The three terms are typically based on the pavement appearance and/or ride quality at the time of rating. Descriptive classification of good, normal or fair, and poorly performing asphalt concrete (AC) and Portland cement concrete (PCC) pavements were previously addressed in four FHWA reports published in 1998, 1999, 2011, and 2012 (Khazanovich et al. 1998, Rauhut et al. 1999, Guerre et al. 2011, Guerre et al. 2012). The shortcomings of the first two reports are that the descriptive term is based on the last collected pavement condition data as shown in Figure 2.7. Figure 2.8 depicts the actual time dependent IRI data for three in-service pavement sections located in the state of Washington. Over the 10-year period, the sections were not subjected to any pavement treatment. Figure 2.8 clearly shows that:

1. Data along a 2.4-mile segment of Road 2 indicate that the descriptive term changes from good to fair to poor in only three years. Thus, the descriptive terms do not accurately reflect the true pavement performance.
2. Data along a 3.6-mile segment of Road 3 change performance descriptions over time from poor to fair (labeled normal in the reports) and then to good.
3. Data along a 4.8-mile segment of Road 1 show that the pavement description fluctuates between good and fair and then between fair and poor. Once again, Khazanovich's descriptive terms do not reflect the true in-service pavement performance over time.
4. After construction, Roads 1 and 2 are considered good, and then at the pavement age of 4 years, the description of Road 1 is fair while Road 2 is poor. The pavement rate of deterioration is not reflected in the characterization.

The three descriptive terms could be improved to better express the pavement conditions if they are based on the pavement's rates of deterioration.

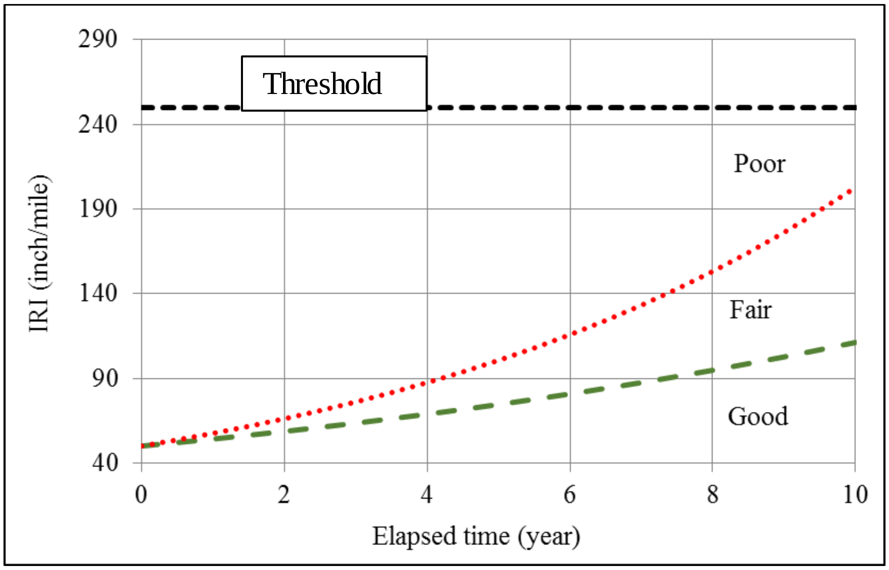


Figure 2.7 Pavement condition classification system (after Khazanovich et al. 1998)

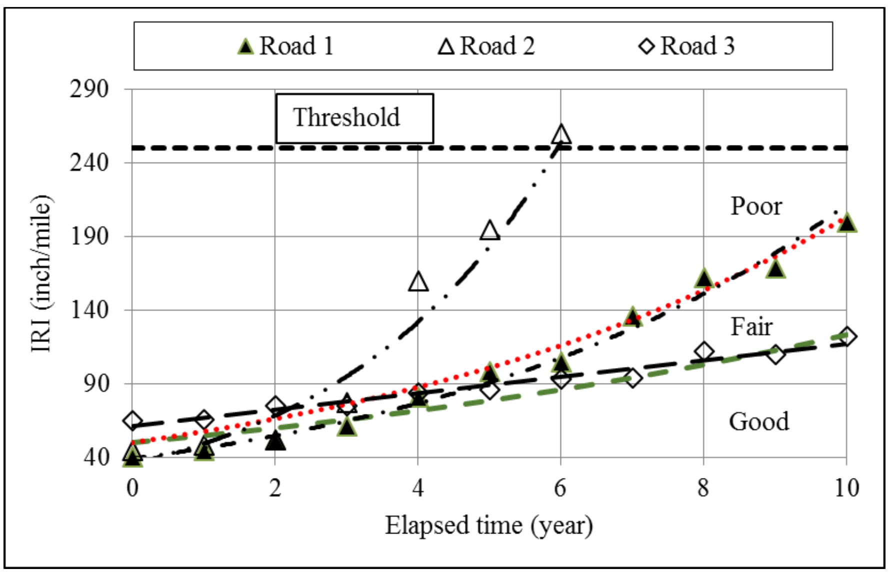


Figure 2.8 Shortcomings of Khazanovich et al. recommended classification system when dealing with real but good data (not the worst case scenario)

On the other hand, Guerre et al. 2012 describes the terms good, fair, and poor pavements and their potentially associated treatment categories as follows:

- Good – Pavement infrastructure that is free of significant defects and has a condition that does not adversely affect its performance. This level of condition typically only requires preventive maintenance activities.
- Fair – Pavement infrastructure that has isolated surface defects or functional deficiencies. This level of condition typically could be addressed through minor rehabilitation, such as overlays and patching of pavements that do not require full depth structural improvements.
- Poor – Pavement infrastructure that is exhibiting advanced deterioration and conditions that impact structural capacity. This level of condition typically requires structural repair, rehabilitation, reconstruction, or replacement.

Once again, the significant issue with these types of definitions is that they do not consider the changes in conditions and distresses over time. The terms do convey the current conditions of a pavement well, but “pavement health” is not best demonstrated by a snap-shot in time. The pavement conditions and distresses generally deteriorate with time and the “pavement health” depends on the current conditions and the rates of deterioration over time. The specific terms could still serve their purpose but the criteria used to assign the rating should be modified to account for the effects of time. Consideration of condition and rates of deterioration facilitates planning and pavement management, while condition alone is limited in use as a tool for managing pavement.

2.5 Pavement Performance Modeling and Prediction

The performance of a pavement segment is often illustrated by the progression of pavement condition or distress over time as shown in Figure 2.9. The level of performance at any given time is equivalent to the level of pavement condition or distress at that time relative to the threshold value. Therefore, the performance of a pavement segment over its service life is defined by the level of service over time or by the accumulation of damage over time (Chatti et al. 2005).

Most SHAs collect pavement condition and distress data. Some use the data to observe the condition of the pavement, while others use the time series pavement condition and distress data to predict future pavement conditions. The combination of both practices allows for the development of current and future strategies for management of the pavement network.

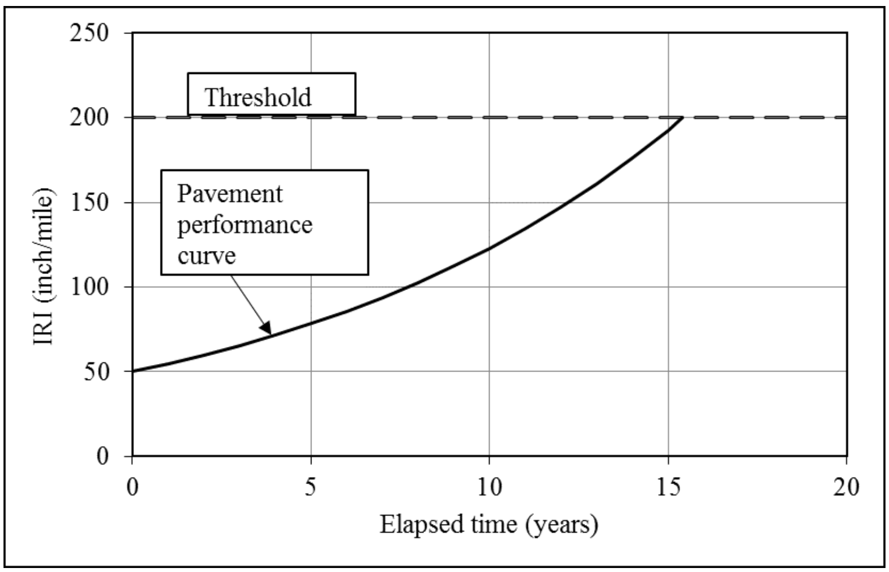


Figure 2.9 A typical pavement performance curve

Many SHAs have studied the effectiveness of various pavement treatments using historical pavement performance data. Based on the various studies, the minimum and maximum treatment service lives listed in Table 2.2 were published in the various sources listed for each treatment type. These estimated averages are adequate to be used in the analysis at the network level. For project level analysis, more accurate estimates are required. Such estimates could be based on predictions of past and future pavement conditions through the modeling of pavement condition and distress data before and after treatment to create pavement performance curves. Several predictive pavement performance models have been developed to estimate the pavement performance curve based on parameters such as traffic, weather, and pavement type. The various methods include straight-line extrapolation, regression, polynomial constrained least squares, application of S-shaped curves, use of probability distributions, and Markov chain models (Ahmed et al. 2006). One such example, for thin hot-mix asphalt (HMA) overlays, is presented in Equation 2.2. The β parameters were determined for different performance indicators (IRI, Pavement Condition Rating (PCR), and rut depth) as well as different road types (Interstate, non-Interstate highway, and non-highway) (Irfan et al. 2009).

$$PI = e^{\beta_1 + \beta_2 * CAATT + \beta_3 * CAFDX} \qquad \text{Equation 2.2}$$

Where, PI is the value of the performance indicator (IRI, PCR, RUT) for a pavement segment in a given year;

CAATT is the cumulative average annual daily truck traffic (in millions) predicted for the pavement segment from the time of treatment to the given year;

CAFDX is the cumulative annual freeze index (in thousands of degree-day) predicted from the time of treatment to the given year; and β_1, β_2, and β_3 are statistical parameters.

The most common method for modeling pavement condition and distress data as a function of time is by ordinary least squares regression. It should be noted that a minimum of three time series data points are required to model the nonlinear data. The method is used to determine the parameters of the selected mathematical function, such as those listed in Table 2.3 (M-E PDG 2004, Dawson 2012), by minimizing the sum of squared errors. This method works when the particular pavement segment is deteriorating following the selected model. If the method does not capture the true progression of the condition or distress over time, other models may be required (Luo 2005).

Table 2.2 Estimated and reported pavement treatment service life

Treatment type	References	Estimated treatment service life expectancy (year)		
		Minimum	Average	Maximum
Thin (< 2.5 inch) HMA overlay	Geoffroy 1996, Hicks et al. 2000, Johnson 2000, ODOT 2001, Wade et al. 2001, MDOT 2001, Peshkin et al. 2004	2	8	12
Thick (≥ 2.5 inch) HMA overlay	FHWA 2010	6	10	17
Single chip seal	Geoffroy 1996, Hicks et al. 2000, Johnson 2000, Bolander 2005, Gransberg & James 2005	1	6	12
Double chip seal	Hicks et al. 2000, Johnson 2000, MDOT 2001, Bolander 2005, Maher et al. 2005	4	9	15
Thin (< 2.5 inch) mill & fill	MDOT 2001, FHWA 2010	4	8	20
Thick (≥ 2.5 inch) mill & fill	FHWA 2010	6	10	17
Cold-in-place HMA recycling	Hicks et al. 2000, Morian et al. 2004, Maher et al. 2005	5	10	20
Crack sealing	Geoffroy 1996, Johnson 2000	2	3	10
Micro-surfacing	Geoffroy 1996, Smith & Beatty 1999, Johnson 2000, Wade et al. 2001, Peshkin et al. 2004, Labi et al. 2006	4	6	10

Another method of modeling pavement condition and distress data is the cluster wise regression procedure, which was introduced by Spath 1979, 1981, 1982, and was modified by Meier 1987, DeSarbo et al. 1989, Lau et al. 1999, and Luo 2005. Cluster wise regression involves splitting the data into sub-groups based on their characteristics and fitting separate models to each sub-group. The resulting pavement performance models could be more accurate as they model small subsets of data with similar trends. However, the resulting models are discrete (each model represents a certain time period).

2.6 Pavement Preservation Benefits

Most existing procedures for estimating pavement preservation benefits are based on the prediction of future pavement performance, comparison of the pavement performance before and after treatment, and immediate changes in the pavement conditions due to treatment. Various definitions of pavement condition and performance measures are presented below.

1. Remaining Service Life (RSL) – RSL is the estimated number of years, from any given year (usually from the last condition survey year), to the date when the conditions of the pavement section reach a pre-specified threshold value. For each pavement section, the required steps for calculating the RSL are:
   - Download from the database the pavement surface age, and three or more consecutive pavement condition data points collected over a time period where no treatment was applied.
   - Use the condition data points and the corresponding data collection times to obtain the equation of the best fit curve using the proper mathematical function.
   - Input to the best fit equation the threshold value of the condition or distress index in question and calculate the time in years between construction and the time when the pavement condition will reach the pre-established threshold value. The RSL is the difference between the calculated time and the pavement surface age.

In the case of a new pavement structure or a newly rehabilitated pavement, the estimated RSL value must be positive and restricted to be less than or equal to the design life of the pavement or the treatment as stated in Equation 2.3 (Baladi et al. 1992). The reason is that for a few years after treatment, the pavement may or may not show any distress and hence the estimated RSL is very large and meaningless. The restriction could be dropped when a significant number of data points indicating pavement deterioration are available.

$$0 \le RSL = \left\{ t\left(PC = Th\right) - SA \right\} \le \left(DSL - SA\right) \qquad \text{Equation 2.3}$$

Where, t (PC = Th) is the time (the number of years) at which the pavement condition reaches the threshold value (Th);

SA is the pavement surface age in years; and

DSL is the pavement design service life in years.

It should be noted that the accuracy of RSL is a function of the accuracy and variability of the pavement condition data. In addition, the accuracy of the estimated RSL decreases as the value of RSL increases (predicting much farther in time).

The RSL of a given pavement network can be calculated as the weighted average RSL of the "n" pavement segments within the network using Equation 2.4. It should be noted that any pavement segment that falls below the threshold value has a zero RSL. In general, no negative RSL should be assigned to any pavement regardless of its condition. For a newly designed and constructed or rehabilitated pavement segment, its RSL is equal to the design life (Baladi et al. 1992).

$$RSL_{network} = \frac{\sum_{i=1}^{n} \left(RSL_i\right)\left(SL_i\right)}{\sum_{i=1}^{n} SL_i} \qquad \text{Equation 2.4}$$

Where, i is the i^{th} pavement segment;

n is the total number of pavement segments or sections in the network;

RSL is the remaining service life; and

SL is the segment length.

Table 2.3 Typical pavement condition models (M-E PDG 2004, Dawson 2012)

Pavement condition/ distress type	International Roughness Index (IRI) (inch/mile or m/km)	Rut depth (RD) (inch or mm)	Cracking (length, area, or percent)
Model form	Exponential	Power	Logistic (S-shaped)
Generic equation	$\mathrm{IRI} = \alpha \exp(\beta t)$	$\mathrm{RD} = \gamma\, t^{\omega}$	$\mathrm{Crack} = \dfrac{k}{1 + \exp[-\theta(t - \mu)]}$
Time when a threshold value is reached	$t = \dfrac{\ln\left(\dfrac{\mathrm{Threshold}_{\mathrm{IRI}}}{\alpha}\right)}{\beta}$	$t = \exp\left[\dfrac{\ln\left(\dfrac{\mathrm{Threshold}_{\mathrm{RD}}}{\gamma}\right)}{\omega}\right]$	$t = -\left[\dfrac{\log\left(\dfrac{k}{\mathrm{Threshold}_{\mathrm{Crack}}} - 1\right) - \theta * \mu}{\theta}\right]$
Derivative (rate of deterioration)	$\dfrac{d\,\mathrm{IRI}}{dt} = \alpha\,\beta \exp(\beta t)$	$\dfrac{d\,\mathrm{RD}}{dt} = \gamma\omega t^{(\omega - 1)}$	$\dfrac{d\,\mathrm{Crack}}{dt} = -\dfrac{k * \theta * \exp(\theta(t + \mu))}{(\exp(\theta t) + \exp(\theta\mu))^2}$
Integral (area)	$A_{\mathrm{IRI}} = \int_{t_1}^{t_2} = \left(\dfrac{\alpha}{\beta}\right)\exp(\beta t)$	$A_{\mathrm{RD}} = \int_{t_1}^{t_2} = \dfrac{\gamma\, t^{(\omega+1)}}{(\omega + 1)}$	$A_{\mathrm{Crack}} = \int_{t_1}^{t_2} = k\left[\mu - \dfrac{\log(\exp(\theta(\mu - t)) + 1)}{\theta}\right]$
Where, α, β, γ, ω, k, θ, and μ are regression parameters, RD is rut depth, Crack is crack length, area or percent, t is the elapsed time in years, and Threshold is the pre-specified condition or distress level indicating zero serviceability for any given pavement condition or distress type.			

2. Remaining Service Interval (RSI) – RSI is similar to RSL with some changes. RSI is a new pavement performance measure that is being analyzed on a current research study sponsored by the FHWA. The final algorithm of the RSI was not used in this study because it did not become available during the study with sufficient time for review.
3. Service Life Extension (SLE) – SLE is the gain in service life resulting from a pavement treatment, as shown in Figure 2.10 (Dawson et al. 2011). The accuracy of SLE is a function of the accuracy of the two estimated RSL values, before and after treatment. SLE is a useful tool for determining the time benefit due to a pavement treatment.
4. Treatment Life (TL) – TL is the time between the treatment date and the date when the pavement conditions or distresses reach the lesser of the threshold value or the before treatment pavement condition or distress, as shown in Figure 2.11. TL involves the same limitations as the predicted RSL value after treatment (note that, the TL does not require any RSL prediction before treatment), except with a shorter prediction in time. TL is a good tool to determine the time until the before treatment conditions return. In the case of worse pavement condition or distress AT, the TL is taken as the negative of the time for the BT conditions or distresses to reach the AT conditions, as shown in Figure 2.12 (Dawson et al. 2011).
5. Total Benefits (TB) – TB is the ratio of the benefit area to the do nothing area, as depicted in Figure 2.13 (Peshkin et al. 2004). TB accounts for the improved condition over a given time, the area bound by the performance curve and a threshold value; however it has some significant flaws. TB can be misunderstood because two pavement sections can have the same area ratio but completely different performance. Stated differently, any ratio can be obtained by the division of an infinite set of two numbers such as 1 and 3, 2 and 6, 6 and 18

and so forth. The different perspective of the TB is that the benefit area is normalized relative to the do nothing area. The do nothing area, on the other hand, is a function of the pavement conditions and rate of deterioration before treatment.

6. Performance Jump (PJ) – PJ is the immediate improvement in the pavement condition due to treatment (Labi & Sinha 2003). The PJ indicates the temporary improvement resulting from treatment but has no way to predict the future conditions or how long the improvement will last. Example of PJ is depicted in Figure 2.14.
7. Deterioration Rate Reduction (DRR) – DRR (see Figure 2.14) is the change in deterioration rate from immediately before to immediately after treatment (Labi & Sinha 2003). The measure is short-term and therefore is not a true measure of performance.

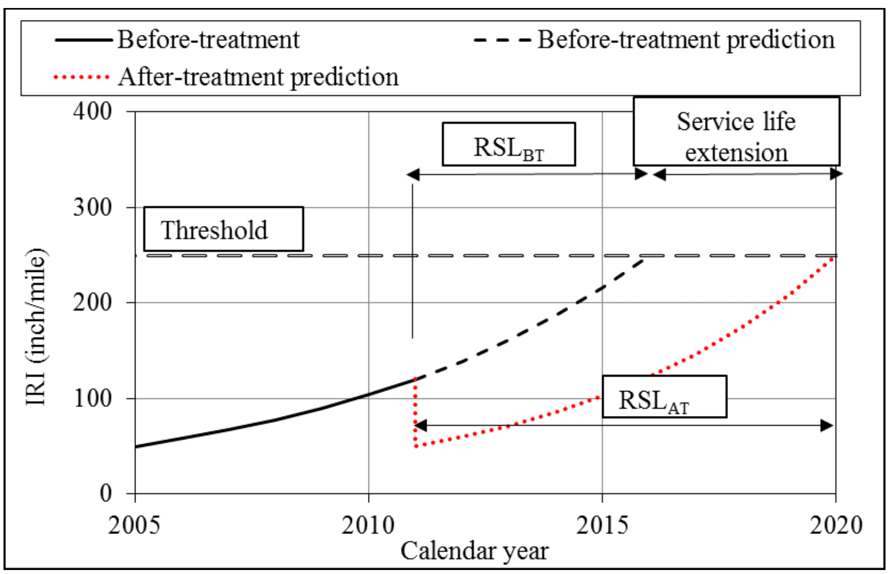


Figure 2.10 Schematic of the definition of SLE

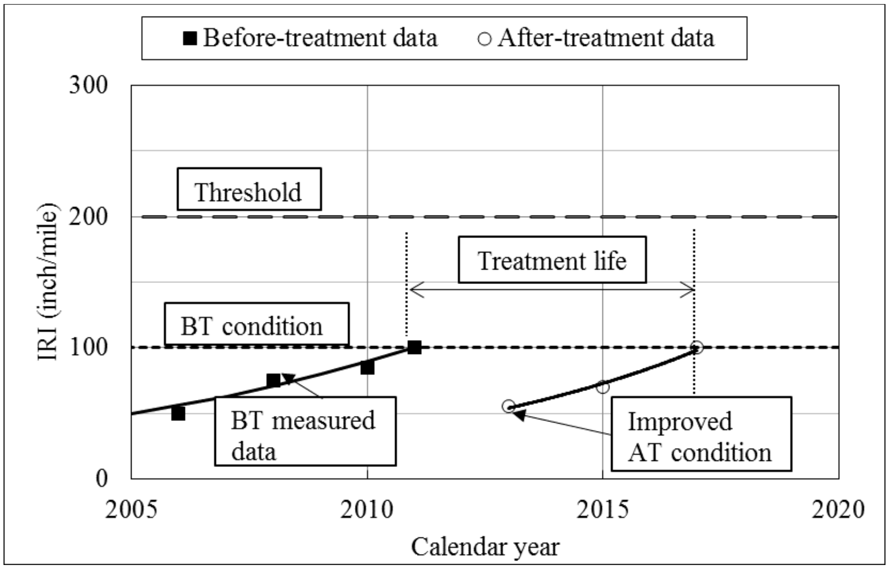


Figure 2.11 Schematic of the definition of TL

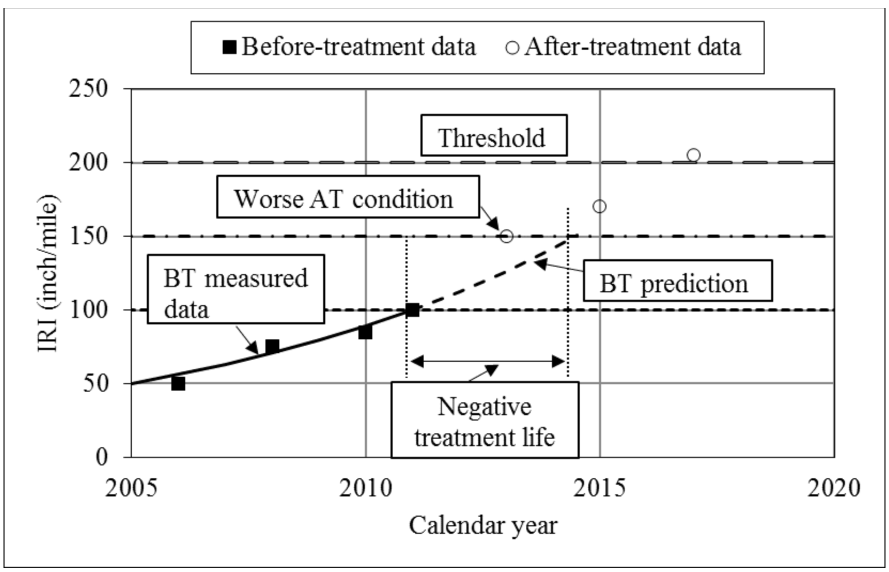


Figure 2.12 Schematic of the definition of negative TL

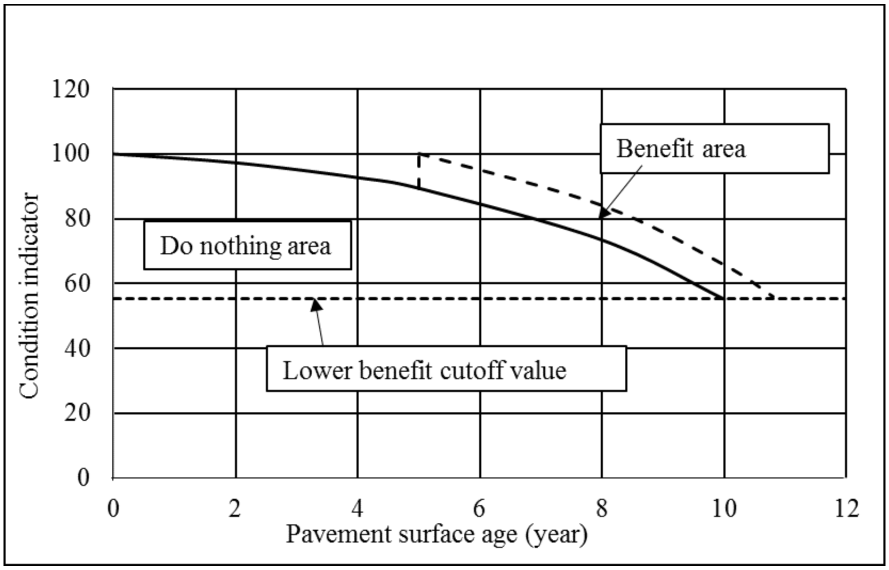


Figure 2.13 Schematic of the definition of total benefit (after Peshkin et al. 2004)

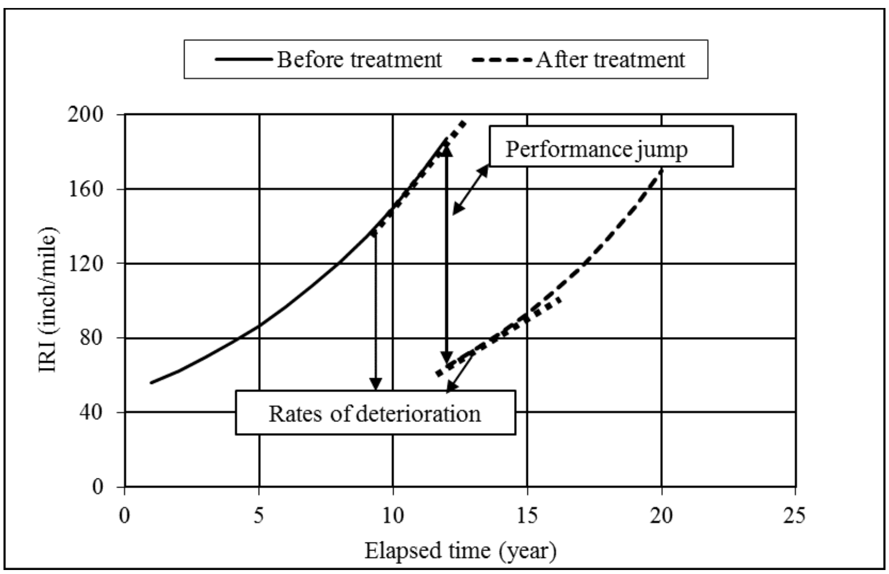


Figure 2.14 Performance jump and deterioration rate reduction

2.7 Pavement Treatment Types

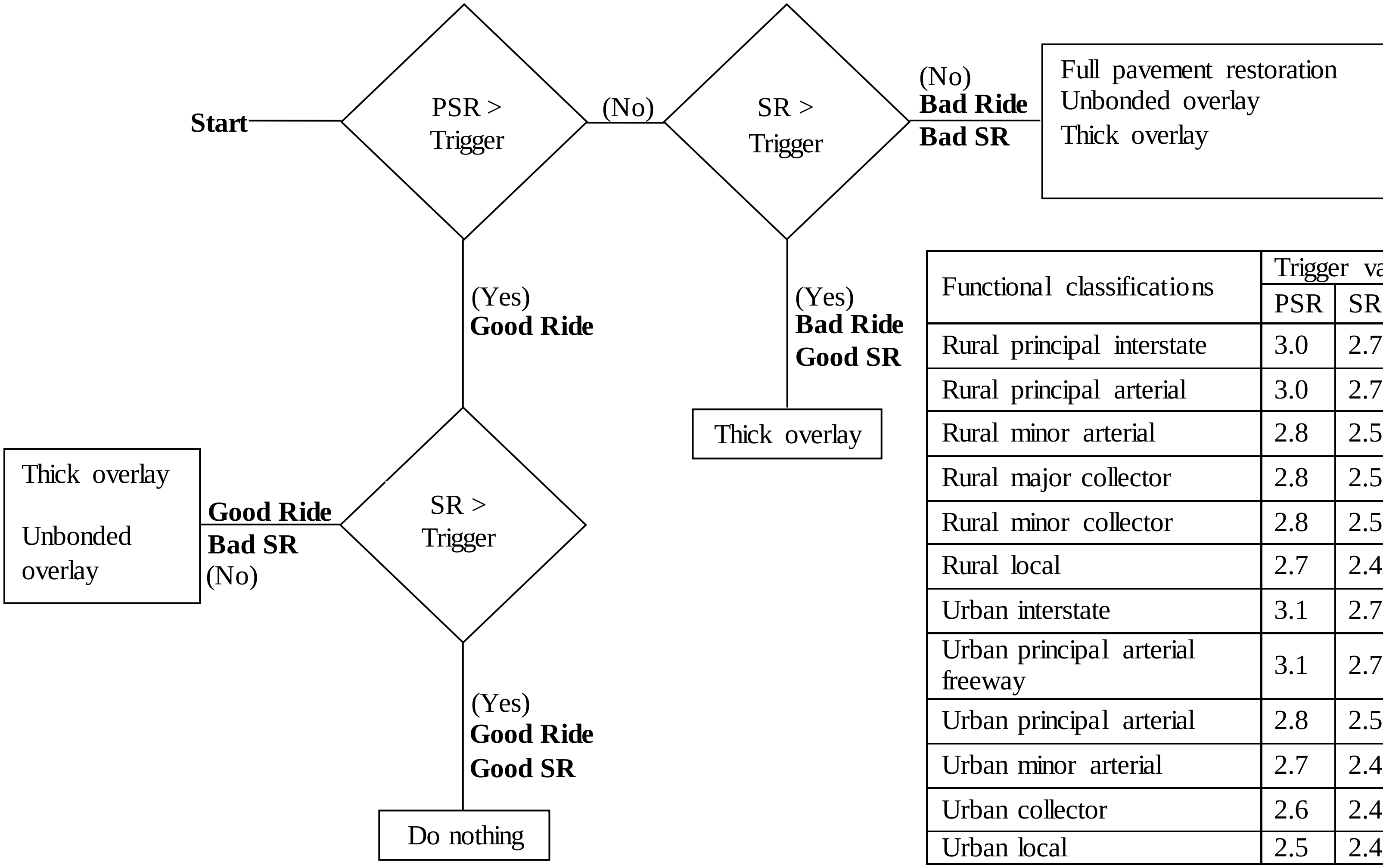
The number of available pavement treatment types is large and ever growing as new techniques and materials are developed. Each SHA tends to have a select group of treatments which they choose to apply based on their experience and the results they have achieved over time. The selection of a particular pavement treatment from the pool of treatment options is also often SHA specific. Discussion of the pavement treatment selection process follows.

2.8 Pavement Treatment Selection

Many SHAs have developed plans and methodologies for selecting pavement treatments. The most common are decision trees and matrices. These are often developed from past experience and tend to focus on one or two options. The trees/matrices are rarely updated and often neglect new technology. Examples of a decision tree and a decision matrix are shown in Figure 2.15 and Table 2.4. Nonetheless, they are typically based on the following (Hicks et al. 2000):

- Pavement surface type and/or construction history.
- An indication of the functional classification and/or traffic level.
- At least one type of condition index, including distress and/or roughness.
- More specific information about the type of deterioration present, either in terms of an amount of load-related deterioration or the presence of a particular condition or distress type.
- Geometric data indicating whether or not pavement widening or shoulder repair are required.
- Environmental conditions in which the treatment is to be used.

The pavement treatment type should be selected based on the pavement conditions and distresses and their causes (Baladi et al. 1999). Note that a pavement treatment that addresses the conditions but not their causes may not be "the optimum option". However, at the network level, it could be the only available option given the budgetary constraints.



Functional classifications	Trigger values		
	PSR	SR	PQI
Rural principal interstate	3.0	2.7	3.0
Rural principal arterial	3.0	2.7	2.9
Rural minor arterial	2.8	2.5	2.8
Rural major collector	2.8	2.5	2.6
Rural minor collector	2.8	2.5	26
Rural local	2.7	2.4	2.6
Urban interstate	3.1	2.7	3.0
Urban principal arterial freeway	3.1	2.7	2.9
Urban principal arterial	2.8	2.5	2.9
Urban minor arterial	2.7	2.4	2.8
Urban collector	2.6	2.4	2.6
Urban local	2.5	2.4	2.6

PSR = Present serviceability rating; SR = Surface rating; PQI = Pavement quality index

Figure 2.15 Example of decision tree for continuously reinforced concrete pavement (CRCP) (Hicks et al. 2000)

Table 2.4 Example of decision matrix (Asphalt Institute 1983)

Problem	Possible cause				Maintenance				Rehabilitation					
	Structural failure	Mix composition	Temperature or moisture	Construction	Patching & routine maintenance	Fog seal	Surface treatment	Slurry seal	Surface recycling	Thin overlay	Open-graded surface	Structural overlay	Structural recycling	Reconstruction
Alligator cracking	X				X		X	X				X	X	X
Edge joint cracks	X		X	X	X									
Reflection cracks					X		X	X			X	X	X	
Shrinkage cracking		X	X				X	X	X		X	X	X	
Slippage cracks				X	X									
Rut depth	X	X		X					X	X		X	X	X
Corrugation	X	X		X					X	X		X	X	X
Depressions	X			X	X								X	X
Upheaval			X		X								X	X
Potholes	X		X	X	X							X		
Raveling		X		X		X	X	X	X	X				
Flushing asphalt		X		X			X		X		X			
Polished aggregate		X	X				X		X	X	X			
Loss of cover		X		X			X							

The cost-effectiveness of the treatment can be determined by evaluating the conditions of the pavement over time. Pavement treatment selection should consider the timing of the treatment along the service life of the pavement. The pavement treatment effectiveness is typically dependent on the conditions at the time of treatment. Study of the relationships between the conditions and time, and the deterioration rate, can lead to the selection of pavement treatments at the most cost-effective time. Analysis of the pavement condition and distress data in time series can be based in parts on the BT and AT RSL. The BT and AT RSL values could be grouped into brackets and referred to herein as “Condition States (CS)” or “RSL brackets”. Dawson et al. (2012) suggested the five RSL brackets or CSs:

- CS 1 or RSL bracket 1 with RSL range from 0 to 2 years and average of 1 year.
- CS 2 or RSL bracket 2 with RSL range from 3 to 5 years and average of 4 years.
- CS 3 or RSL bracket 3 with RSL range from 6 to 10 years and average of 8 years.
- CS 4 or RSL bracket 4 with RSL range from 11 to 15 years and average of 13 years.
- CS 5 or RSL bracket 5 with RSL range from 16 to 25 years and average of 20.5 years.

Note that higher CS or RSL bracket has wider RSL range; this is due to the increasing uncertainty associated with longer prediction of RSL into the future.

One objective of performing a treatment on a pavement section is to improve the conditions of the pavement. Another objective is to retard the pavement rate of deterioration. This could be achieved if the selected treatment reduces or eliminates the causes of the conditions or distresses. Pavement treatments that do not address the causes of conditions or distresses will not prevent the previous conditions from returning (Baladi et al. 1999).

Several pavement treatment types could be applied to a pavement section to address one or several pavement conditions and distresses. Similarly, several pavement treatment types could be applied to address one or several causes of those conditions and distresses. For example, localized patching could be applied to address areas of fatigue cracking, while an HMA overlay will cover all existing cracks and material defects and will fill the rut channels. However, neither treatment may address the causes of the distresses, which could require improvements to the lower layers and/or drainage considerations. If costs were not considered then the preferred treatment could be reconstruction in some scenarios, since it eliminates all distresses and their causes. However, this is likely not the most economical option. Therefore, the treatment(s) which address the most issues and provide the most benefits per dollar spent are preferred at the project level.

2.9 Pavement Preservation Costs

The costs of any pavement treatment can be divided into two categories; agency costs and user costs. The agency cost is the physical cost of the pavement project; including design and construction less the residual value of the pavement section at the end of its life. This is often referred to as direct costs (Morgado & Neves 2008). User costs are much more difficult to estimate than agency costs as they are not based on specific monetary value, but on vehicle operating costs (VOC), delay costs, and accident costs. The three types of user costs and how they relate to normal and work zone conditions are listed in Table 2.5 and discussed in the next few subsections (Morgado & Neves 2008).

Table 2.5 Review of user cost components (Reigle & Zaniewski 2002)

Component	Normal operation	Work zone conditions
Vehicle operating cost (VOC)	Based on total delay hours caused by accidents	Based on total delay hours caused by work zone and accidents in the work zone
Delay	Total delay hours (due to accidents)	Total delay hours (due to work zone and accidents in work zone)
Accidents	Number and severity of accidents	Number and severity of work zone accidents

One problem that arises when estimating user costs is the transformation of delay, accidents, etc. to a monetary value (Khurshid et al. 2009). Some believe that user costs should be defined as "user benefit" and expressed qualitatively as improvements in performance or safety (Mouaket & Sinha 1991, Lamptey et al. 2004). The user benefits of one treatment relative to another or to the do nothing alternative could be used to select between treatments with similar agency costs. In other words, if two treatment options satisfy the pavement needs and have similar agency costs, then the deciding factor would be the user costs. This would greatly simplify the process which is often considered to be complicated and deficient, especially when applicable data are not available for the various detailed user cost models (Fazil & Paredes 2001). However, life cycle cost analysis (LCCA) should be completed to evaluate both the agency and user costs over the pavement life cycle and to select the most cost-effective treatment strategy. For completion, these costs and LCCA are discussed in the next few subsections.

2.9.1 Life Cycle Cost Analysis (LCCA)

Recently, SHAs are faced with many constraints such as public demand for quality pavement and budget short-fall. Hence, their issues become (Baladi et al. 2011):

- What pavement preservation alternatives should be used, and hence, how often should a given pavement section be preserved?
- How many miles of each pavement class should be preserved annually?
- What is the optimum time or the optimum pavement conditions and distresses at which pavement preservation actions should be taken?
- What are the associated agency and user costs and benefits of each pavement treatment?
- What are the optimum and most cost-effective short and long-term pavement preservation strategies that can be applied to keep the pavement network healthy in a cost-effective manner?

The above questions cannot be properly and accurately answered unless LCCA is conducted. Such analysis should address the agency and the user costs and must be based on accurate and up-to-date data so that the costs and benefits of various pavement preservation alternatives can be compared.

2.9.1.1 The Need for LCCA

In general, highway pavements are designed and constructed to provide services for a limited time called the service life. Over time, the combined effects of traffic loads and environmental factors accelerate the pavement deterioration and reduce its level of serviceability. Maintenance, preservation, and rehabilitation treatments are designed and applied to pavement sections to slow their rates of deterioration and to extend their service lives. The application of most pavement treatments requires traffic control (lane closures and/or detours), which significantly impacts traffic flow, increases travel time, and increases VOCs. The costs and benefits of pavement treatments are comprised of many elements including:

1. Agency costs of the pavement treatment, which consist of many attributes including:
    - Material and contractual costs.
    - The cost of traffic control in the work zone, which is defined as an area along the highway systems where maintenance and construction operations adversely affect the number of lanes opened to traffic or affect the operational characteristics of traffic flow through the work zone (Chien et al. 2002).
    - Quality assurance and quality control (QA/QC) costs.
    - The costs of future treatments.
2. Agency benefits, which could be measured by the life of the treatment or the service life extension (SLE) of the treated pavement sections.

3. User costs, which are also comprised of many attributes including (Lewis 1999, Daniels et al. 2000):
    - Time delay user costs or work zone user costs, which are defined as the associated costs of time delays due to lane closures because of roadway construction, rehabilitation, and maintenance activities (Berthelot 1996).
    - Costs incurred by those highway users who cannot use the facility because of either agency or self-imposed detour requirements (Walls & Smith 1998).
    - VOCs in terms of fuel, wear and tear, and depreciation over the delay periods.
    - Accident costs.
    - Environmental costs due to air pollution caused by excessive uses of gasoline or diesel fuel due to lower speed and time delay, including noise pollution.
4. User benefits which are comprised of improved serviceability and ride quality that would lower the VOCs and improve traffic flow.

2.9.1.2 Methods of LCCA

Since LCCA considers all planned pavement treatments of a given analysis period, the service life and the value of money over time should be considered. One hundred dollars in 2014 will likely buy much more than one hundred dollars will in 2024. Hence, two common methods incorporated in LCCA to account for this are summarized below:

A. Net Present Worth

The net present worth (NPW) or net present value is a common economic indicator. NPW is the monetary value of an action accounting for the transformation of the value of money over time using the discount rate (see Equation 2.5). The use of NPW allows for fair comparison of actions taken at different times by converting to a common unit of measure (Walls & Smith 1998).

$$NPW = initial\,cost + \sum_{k=1}^{N} Preservation\,Cost_k \left[\frac{1}{(1+i)^{n_k}} \right] \qquad \text{Equation 2.5}$$

Where, NPW is the net present worth; N is the total number of preservation treatments; i is the discount rate; n is the number of years into the future; and k is the k^{th} action.

The discount rate reflects the rate of inflation adjusted to the opportunity cost to the public. The opportunity cost is often indicated by the conservative US Treasury Bill. The historical inflation rate trend from 1999 to 2014 indicates a range of -0.35 to 3.58 with an average of 2.39. Table 2.6 lists common discount rates used by SHAs in the 1990s. The discount rate should reflect historical trends in the nation or region where the analysis is conducted (Walls & Smith 1998). Alternatively, the discount rate could be determined from the consumer price index (CPI). The average CPI discount rate from 2001 to 2010 was about 2.54% (Baladi et al. 2011, BLS 2011).

B. Equivalent Uniform Annual Cost

The Equivalent Uniform Annual Cost (EUAC) method is also widely used as a common economic indicator in LCCA and is typically derived from NPW as stated in Equation 2.6. The use of either value allows for fair comparison of actions taken at different times by converting to a common unit of measure (Walls & Smith 1998).

$$EUAC = NPW \left[\frac{(1+i)^n}{(1+i)^n - 1} \right] \qquad \text{Equation 2.6}$$

Where, EUAC is the equivalent uniform annual cost; NPW is the net present worth; i is the discount rate; and n is the number of years into the future.

2.10 Pavement Preservation Effectiveness

In the past, some SHAs allowed their pavement assets to deteriorate to levels requiring major rehabilitation or reconstruction. For many years, their treatment policies were based on "worst-first” policy while the rest of the pavement network is deteriorating. Recently, many SHAs have initiated and implemented pavement preservation programs at the network level.

Table 2.6 Historical discount rates

Year	Analysis period (year)				
	3	5	7	10	30
1992	2.7	3.1	3.3	3.6	3.8
1993	3.1	3.6	4.0	4.3	4.5
1994	2.1	2.3	2.5	2.7	2.8
1995	4.2	4.5	4.6	4.8	4.9
1996	2.7	2.7	2.8	2.8	3.0
1997	3.2	3.3	3.4	3.5	3.6
1998	3.4	3.5	3.5	3.6	3.8
Average	3.1	3.3	3.4	3.6	3.8
Effects of discount rates on $100 from 2014 to 2024 using the average CPI of 2.54%					
$100 in 2014 has the same purchasing power as $128 in 2024					

The programs are based on cost-effective treatment of sections of the pavement network in relatively good condition to restore their conditions, decrease their rates of deterioration, and enhance the safety of the motorists. Over time, the preservation program becomes a part of the annual pavement treatment strategy of the SHA (Geiger 2005). The pavement preservation program typically consists of light pavement treatments such as crack sealing, non-structural overlay, light rehabilitation actions, mill and fill, and so forth. The alternative to pavement preservation is the old practice of letting the pavement network deteriorate until expensive rehabilitation or reconstruction actions are necessary. Several studies have been conducted on the effectiveness of pavement preservation and are summarized in the following subsections.

The effectiveness of pavement treatments can be measured in the short-term and/or the long-term. Short-term benefits are defined by the immediate improvement to the pavement conditions and rates of deterioration, while long-term benefits are defined over the service life of the pavement section by the performance and extension in service life. The costs can also be short-term (individual treatment) or long-term (LCCA).

2.10.1 Pavement Preservation Cost-Effectiveness at the Project Level

Pavement preservation can be applied through a series of pavement treatments over the pavement life cycle (a treatment strategy). The alternative to pavement preservation is allowing the pavement to deteriorate until reconstruction is required, the "worst-first" or do nothing scenario. The cost-effectiveness of pavement preservation at the project level can be quantified using LCCA. The analysis could be conducted on the various alternative pavement preservation treatments which could be applied to a pavement section over time and on the do nothing scenario followed by reconstruction. Comparison of the results from the various strategy-analyses indicate the cost savings or extra expenditures of performing preservation over the life of the pavement segment.

The cost-effectiveness of pavement preservation, at the project level, has been well documented. Most literature agree that pavement preservation can be conducted at minimal cost and create large savings over the life of the pavement. One study found that the cost savings of pavement preservation was as high as five dollars saved for every dollar spent on preservation (Construction and Maintenance Fact Sheets 2000). Another reports savings of 4 to 10 dollars for every dollar spent on preservation (Baladi et al. 2002). Other benefits include improving ride quality and creating a pavement network with consistent needs from year to year (Adams & Kang 2006).

2.10.2 Pavement Preservation Effectiveness at the Network Level

The effectiveness of pavement preservation at the network level is more difficult to quantify than at the project level. Funds designated to preservation reduce the amount of funds available for rehabilitation and reconstruction. In other words, pavement preservation is thought to decrease the life cycle cost of a given pavement project, but the effect on the network is often unknown. Additionally, the public and the legislators may not understand why pavements in seemingly good conditions are being treated while others in poor conditions are not. The SHAs should document and communicate the effects of preservation maintenance on the health of the pavement network and on the life cycle cost in a clear and consistent manner. Educating the public and the legislature is necessary to establish and maintain a successful pavement preservation program (Adams & Kang 2006).

The short and long-term benefits and effectiveness of pavement preservation at the project and network levels should be quantified. Short term benefits include improving ride quality and addressing safety issues, while long-term benefits (cost savings) are not realized until years or decades into the future. Therefore, pavement preservation strategies must be optimized through projection of needs and funds into the future. In this way the effects of performing or deferring various pavement projects can be evaluated (DelDOT 2001, Adams & Kang 2006).

2.11 Treatment Transition Matrix (T^2M)

Pavement treatment effectiveness is often described with a single value or a range of values, such as 5 to 10 years gained or an average of 7-year service life. The probabilities of the various results are not typically reported. The probabilistic effectiveness of treatments can be quantified and communicated through the use of an innovative matrix format called Treatment Transition Matrix (T^2M) (Dawson 2012). The information listed in the T^2M show:

- The distribution of the pavement condition states (CSs) before and after treatment.
- The transitions of the pavement CSs from BT to AT due to the treatment.
- A list of the treatment benefits.

- A “snap-shot in time” of the long-term results of the pavement treatment.

Table 2.7 shows an example of T^2M listing the results of single chip seal applications in Colorado. The cells display the above information in a convenient way as detailed below:

- Columns A through D of Table 2.7 list the following BT information: the pavement CSs (the RSL bracket numbers), the RSL ranges, the number and the percentages of 0.1 mile long pavement segments in each BT CS.
- Columns E through I of Table 2.7 list the following AT information: the CSs (the RSL bracket numbers), the RSL ranges, and the number or the percent of 0.1 mile long pavement segments transitioned from the given BT CS to each AT CS and the total number or percent of 0.1 mile long pavement segments transitioned to each AT CS.
- Columns J through L of Table 2.7 list the following pavement treatment benefits: the average TL, SLE, and AT RSL of all 0.1 mile long pavement segments transitioned from a given BT CS to all AT CSs, and the overall average TL, SLE, and AT RSL.

2.12 Preservation Timing Selection

The effectiveness of pavement treatments are often determined simply based on the benefits gained, as mentioned above. The benefits, however, do not indicate effectiveness relative to cost, which is the main constraint in all SHAs. Most literature agree that treatments applied to pavements in better conditions will precipitate more benefits (Al-Mansour & Sinha 1994, Labi & Sinha 2003 and 2004); however, the cost of the treatment is a function of the conditions as more or less repairs are required before treatment. Further, the time-value relationship of money affects the cost of the treatment and the cost-effectiveness. Therefore, benefits must be compared relative to the costs to determine the cost-effectiveness of the treatment and to select the treatment timing (Khurshid et al. 2009). Performing pavement treatments at the optimum time

Table 2.7 T^2M for single chip seal, state of Colorado

A	B	C	D	E	F	G	H	I	J	K	L
Condition/distress type: condition/distress causing the minimum RSL before and after treatment											
Before treatment (BT) data				After treatment (AT) data							
				CS or RSL bracket number and range in years, the SE per CS or RSL bracket, and the number of the 0.1 mile long pavement segments transitioned from each CS or BT RSL bracket to the indicated CS or RSL brackets					Treatment benefits in terms of treatment life (TL), service life extension (SLE), and RSL of the treatment (year)		
CS or RSL bracket number	RSL bracket range (year)	0.1 mile long pavement segments		1	2	3	4	5	TL	SLE	RSL
				0 to 2	3 to 5	6 to 10	11 to 15	16 to 25			
		Number	Percent	SE (cannot be calculated for the minimum RSL)							
1	0 to 2	2329	58	125	453	1230	267	254	4	8	9
2	3 to 5	746	18	3	88	379	121	155	3	7	11
3	6 to 10	365	9	1	52	157	55	100	2	4	12
4	11 to 15	141	3	0	8	52	27	54	2	1	14
5	16 to 25	452	11	1	24	128	55	244	1	-5	15
Total/average		4033/	100/	130/	625/	1946/	525/	807/	/3	/6	/10

will provide the greatest benefit-to-cost ratio. The idea of optimum timing is not new, in fact, the concept was built into the AASHTO 1993 design guide. Few methodologies for the determination of optimum treatment timing for preventive maintenance and rehabilitation actions were developed, such as that developed by Peshkin et al. (2004). The methodology is designed to optimize treatment timing based on the treatment benefit (calculated by the area under the performance curve). However, the most cost-effective treatments should consider the pavement longevity and should be based on the ratio of dollars to years of service (Dawson 2012). To improve life cycle costs, the roadway agency should base their preservation strategy on maximizing the longevity of the pavement network rather than maximizing the condition of the network.

2.13 The LTPP Program

The LTPP program was established under the Strategic Highway Research Program (SHRP) in 1987. Since 1991, the FHWA has managed and funded the LTPP program. The program houses two fundamental groups of experiments; the Special Pavement Studies (SPS) and the General Pavement Studies (GPS). The LTPP analysis program has addressed a myriad array of studies of pavement related issues ranging from validation of pavement design procedures, traffic and material variability, and pavement maintenance, preservation, and rehabilitation actions. The conclusions from these studies are documented in countless publications in the forms of Research Reports, Product Briefs, and TechBriefs which have substantially contributed to the development of advanced pavement technology and highlighted the importance of the LTPP program and its associated database.

2.14 Objectives and Scope of LTPP Program

The overall objective of the LTPP program is to collect, store, and make available to researchers, scientists, and the general public various data elements relating to pavement performance. These include the pavement structures and conditions, traffic volume and load, and environmental conditions for various pavement sections located along the existing North American Highway Systems. Over more than a 20 year period, the data have been used by researchers, practitioners, and other stakeholders to assess the long-term performance of pavements under various loading and environmental conditions and with different structural and material compositions. The specific established objectives of the LTPP program include (Elkins et al. 2012):

- Evaluate the existing pavement design methodologies.
- Develop improved design methodologies and strategies for the rehabilitation of existing pavements.
- Develop improved design equations for new and reconstructed pavements.

2.15 LTPP Test Sections

The LTPP program consists of about 2,500 152.4-meter (500-foot) long, mostly in-service test sections located in 50 States in the USA, Puerto Rico, and 10 Canadian Provinces. The test sections are divided among the two main studies entitled SPS and GPS. Some of the SPS test sections were reconstructed to investigate certain pavement engineering factors, while others were specially preserved to study the impacts of some preservation treatments. In contrast, the GPS consist of sections of existing roads that were subjected to various typical maintenance and preservation treatments. Thus, eight types of existing in-service pavements make up the GPS and are being monitored throughout North America. More details on the SPS and GPS test sections can be found throughout the rest of this report.

2.15.1 Special Pavement Studies (SPS)

The SPS are a long-term program designed to study specially constructed, maintained, or rehabilitated pavement sections incorporating controlled sets of experimental design and construction features. The main objective of the SPS experiment is to provide more detailed and complete sets of data to extend and refine the results obtained from the GPS. The SPS consist of nine studies grouped by the five categories listed in Table 2.8 (Elkins et al. 2012).

The SPS involve monitoring the newly constructed pavement sections and the existing pavement sections that were subjected to maintenance or rehabilitation treatments after assignment to the SPS. The SPS is divided into various SPS experiments numbered SPS-1 through SPS-9. Each experiment includes multiple test sites and each test site contains between two and twelve depending on the experiment. Following the original assignment of test sections in 1992, numerous supplemental test sections were constructed by different SHAs to study aspects of particular interest to them (Elkins et al. 2012). The FHWA is initiating new sites for the study of warm mix asphalt (SPS-10) and is currently considering new pavement preservation experiments in addition to the existing SPS.

2.15.2 General Pavement Studies (GPS)

The GPS are also a long-term program designed to study a series of experiments on selected in-service pavement structures with the objective of establishing a national pavement performance database. Pavement sections believed to be built with proper materials and good engineering design were selected as part of the GPS program (Elkins et al. 2012). The pavement structures included in the GPS were constructed or reconstructed up to 15 years prior to the start of the LTPP program. Unfortunately, detailed data were often not available for the period between the original construction time and the time when they were selected for the LTPP program.

However, it was believed that some beneficial insights may be drawn without this data. Finally, some SPS test sections have been reclassified into GPS sections upon the application of rehabilitation treatments. Table 2.9 provides a list of the titles of each of the GPS experiments (Elkins et al. 2012).

Table 2.8 The SPS categories and experiments (after Elkins et al. 2012)

Category	Experiment	Title
Pavement structural factors	SPS-1	Strategic study of structural factors for flexible pavements
	SPS-2	Strategic study of structural factors for rigid pavements
Pavement maintenance	SPS-3	Preventive maintenance effectiveness of flexible pavements
	SPS-4	Preventive maintenance effectiveness of rigid pavements
Pavement rehabilitation	SPS-5	Rehabilitation of asphalt concrete (AC) pavements
	SPS-6	Rehabilitation of jointed Portland cement concrete (JPCC) pavements
	SPS-7	Bonded Portland cement concrete (PCC) overlays of concrete pavements
Environmental effects	SPS-8	Study of environmental effects in the absence of heavy loads
Asphalt aggregate mixture specifications	SPS-9P	Validation and refinements of SUPERPAVE asphalt specifications and mix design process
	SPS-9A	SUPERPAVE asphalt binder study
	SPS-10	Warm mix asphalt (WMA) – In design stage

2.16 Summary of Previous Findings

In this study, previous published reports regarding the LTPP program and data analyses were scrutinized. The topics of these reports include the effects of design factors on pavement performance measures and the selection of appropriate and cost-effective treatment type. However, the findings of these reports did not adequately address the relationships between the maintenance and rehabilitation actions and the performance of the various pavement sections or the optimal timing for treatment application. Nevertheless, some of the relevant reported findings are enumerated and summarized in the following subsections.

Table 2.9 The GPS experiments (Elkins et al. 2012)

Experiment	Title
GPS-1	Asphalt concrete (AC) pavement on granular base
GPS-2	AC pavement on bound base
GPS-3	Jointed plain concrete pavement (JPCP)
GPS-4	Jointed reinforced concrete pavement (JRCP)
GPS-5	Continuously reinforced concrete pavement (CRCP)
GPS-6A	Existing AC overlay of AC pavement (existing at the start of the program)
GPS-6B	AC Overlay using conventional asphalt of AC pavement–No milling
GPS-6C	AC overlay using modified asphalt of AC pavement–No milling
GPS-6D	AC overlay on previously overlaid AC pavement using conventional asphalt
GPS-6S	AC overlay of milled AC pavement using conventional or modified asphalt
GPS-7A	Existing AC overlay on Portland cement concrete (PCC) pavement
GPS-7B	AC overlay using conventional asphalt on PCC pavement
GPS-7C	AC overlay using modified asphalt on PCC pavement
GPS-7D	AC overlay on previously overlaid PCC pavement using conventional asphalt
GPS-7F	AC overlay using conventional or modified asphalt on fractured PCC pavement
GPS-7R	Concrete pavement restoration treatments with no overlay
GPS-7S	Second AC overlay, which includes milling or geotextile application, on PCC pavement with previous AC overlay
GPS-9	Unbonded PCC overlay on PCC pavement

2.16.1 Impacts of Pavement Treatment on Pavement Performance

The reported findings related to the impacts of pavement treatments on the collected pavement condition and distress data of various LTPP experiments are summarized below:

1. For the SPS-3 experiment, it was reported that:
   1.1 Thin asphalt overlay was found to be the most effective maintenance treatment followed by chip seal and slurry seal treatments in terms of roughness, rut depth, and fatigue cracking (Hall et al. 2002).
   1.2 Crack sealing had no significant effect on long-term roughness, rut depth, or fatigue cracking (Hall et al. 2002).
   1.3 Crack sealing had only marginal impact on longitudinal and transverse cracking. This is mainly due to the fact that sealed cracks are counted as separate distresses in the LTPP distress survey procedures (Morian et al. 1997).
2. For the SPS-4 experiment, the findings were inconsistent. Some researchers reported that:
   2.1 Sealed joints performed better than unsealed joints (Morian et al. 1997, Morian et al. 1998), while others reported that there were no significant differences between sealed and unsealed joints (Carvalho et al. 2011).
   2.2 Silicone joint sealant materials performed better than compression seals and hot pours in terms of the overall failure (adhesion loss and joint spalling) (Smith et al. 1999).
   2.3 The lack of significant quantity of data is a drawback in the analyses. Survey measurements of sealed joint/crack were collected for 34 test sites while undersealed section data are available for only 10 sites (Carvalho et al. 2011).
3. For the SPS-5 experiment, it was reported that:

3.1 Thick overlays performed better than thin overlays with respect to transverse and fatigue cracking (Carvalho et al. 2011).

3.2 Inconsistent results were reported for longitudinal cracking, rut depth, and IRI. Some researchers (Rauhut et al. 2000, Von Quintos et al. 2006) reported that there was no apparent effect of thick and thin overlays on rut depth or IRI, while others (Carvalho et al. 2011) reported that thicker overlays provided better IRI.

3.3 Virgin and recycled HMA used in overlays were found to have no significant impact on transverse, longitudinal, or fatigue cracking, rut depth, or IRI (Rauhut et al. 2000, Hall et al. 2002). On the other hand, Carvalho et al. (2011) reported that recycled HMA performed better than virgin HMA with respect to fatigue and transverse cracking in dry climates and/or low traffic roadways. They added that virgin HMA performed better than recycled HMA with respect to rut depth (Carvalho et al. 2011).

3.4 The type of pavement surface preparation performed before overlay had no significant effect on rut depth or IRI (Rauhut et al. 2000, Hall et al. 2002).

3.5 Inconsistent results were reported relative to the effects of pavement surface preparation prior to overlay on long-term cracking performance. Hall et.al (2002) reported that intense and minimal pavement surface preparations have no significant difference relative to long-term cracking performance. Whereas, Carvalho et al. (2011) stated that intensely prepared pavement sections performed better than minimally prepared sections with respect to fatigue and longitudinal cracking.

4. For the SPS-6 experiment, it was reported that:

4.1 The 8-inch AC overlay is the most effective rehabilitation option, followed by the 4-inch AC overlay, and by concrete pavement restoration with and without diamond grinding

(Hall et al. 2002). On the contrary, Carvalho et al. (2011) reported that rehabilitation strategies without AC overlays were best to mitigate the crack initiation and propagation.

4.2 Pavement rut depth on composite pavement is independent of overlay thickness, pre-overlay repairs, and mixture type (Hall et al. 2002).

4.3 No significant difference in long-term cracking performance was detected between (Hall et al. 2002):

(a) Test sections subjected to minimal versus intensive pre-overlay preparation.

(b) Test sections with and without sawed and sealed joints.

(c) Test sections with 4-inch overlays, with sawed-and sealed joints, and cracked and seated sections.

(d) Test sections with 4-inch and 8-inch overlays.

4.4 Fractured PCC sections with an AC overlay performed better in roughness than those non-fractured PCC sections subjected to the same AC overlay. Further, the non-fractured sections that were subjected to AC overlay performed better than non-fractured PCC sections that were subjected to diamond grinding and patching without AC overlay (Ambroz et al. 2005).

4.5 Pavement roughness is independent of whether or not the pavement sections were subjected to sawing and sealing prior to the AC overlay (Hall et al. 2002).

2.16.2 Impacts of Design Variables on Pavement Performance

The findings of various studies relative to the impacts of various design factors on pavement performance are summarized in the next six subsections.

2.16.2.1 Climatic Variables

A study by Khazanovich et al. (1998) suggested that dowel bars should be used in Jointed Plain Concrete Pavements (JPCP) to reduce joint faulting in wet-freeze climates. In dryer climates, the joint spacing should be reduced to decrease transverse cracking potential due to high thermal gradients. This is because the precipitation has two effects on the pavement material temperatures;

1. Precipitation will cool or heat the pavement surface relative to the subsurface temperature, thereby reducing the difference in temperature with depth.
2. Water generally requires much more energy to change temperature than air, binder, and aggregate materials. Therefore, a higher water content or more frequent saturation will reduce the magnitude and rate of heating and cooling of the pavement layers.

Additionally, IRI was found to be higher for similar pavements located in colder and wetter climates than those in other climates. Further, higher initial roughness led to higher rates of deterioration. They stated that the results should be reviewed with caution because the PCC durability was not included in the analysis, which may have affected the results.

A study by Selezneva et al. (2000) indicates that faulting in un-doweled JPCP test sections in dry-freeze regions is similar to those sections in dry-no-freeze regions. The mean faulting values were 3.2, 2.0, 1.6, and 1.0 mm in wet-freeze, wet-no-freeze, dry-freeze, and dry-no-freeze regions, respectively. On the other hand, the doweled JPCP sections showed no significant differences in joint faulting between the wet-freeze and the wet-no-freeze regions. Doweled joint faulting occurred mostly in the dry-freeze regions, followed by the dry-no-freeze and the wet-freeze regions. Sections in the wet-no-freeze regions showed the lowest faulting values.

On the other hand, an initial evaluation of SPS-2 test sections, by Jiang et al. (2001), indicated that for doweled joints in rigid pavements, faulting was most prevalent in the dry-freeze region, followed by the dry-no-freeze, and the wet-freeze regions. Additionally, the total longitudinal crack length was found to be higher in the dry-no-freeze region, followed by the dry-freeze and the wet-freeze regions.

Perera et al. (2001) reported a strong relationship between IRI and climatic conditions for flexible pavements. Higher roughness was measured in pavement sections located in areas with higher precipitation, higher freezing index, and/or higher number of freeze thaw cycles. They also stated that adequate frost protection was an important factor for good pavement performance. In hot climates, roughness values were strongly related to the number of days having temperatures above 32 °C (90 °F). Additionally, the roughness was lower for pavement sections in hot regions with higher precipitation than for those with less precipitation. They related this phenomenon finding to the cooling effect that precipitation may have on asphalt pavements, thereby reducing deformations resulting from high temperatures. On the other hand, rigid, jointed pavements were found to have higher roughness in climates with higher precipitation.

2.16.2.2 Roadbed Soils

A study by Simpson et al. (1994) indicated that better subgrade support (higher backcalculated modulus of subgrade reaction, k-value) resulted in fewer transverse cracks with deteriorated edges and in lower roughness (IRI) for JPCP, JRCP, and CRCP.

A study by Khazanovich et al. (1998) concluded that PCC pavements constructed over fine-grained roadbed soils have higher joint faulting than those constructed on coarse-grained roadbed soils. This is likely due to increased potential for soil erosion and reduced water permeability. Likewise, JPCP sections constructed on coarse-grained roadbed soils have lower IRI than those constructed on fine-grained roadbed soils. They recommended that a thick layer of granular material be placed and compacted beneath the aggregate base course to improve drainage and reduce faulting, especially for non-doweled pavements. The study also concluded that PCC slabs supported on strong foundations, such as stabilized bases or granular roadbed soils, often have a lower initial roughness.

In a study conducted by Mladenovic et al. (2002) using SPS-8 experiment data, it was found that the most prevalent early pavement distress is longitudinal cracking outside the wheel path. Further, this distress was most commonly observed in sections located in the wet-freeze region and on an active roadbed soil (frost-susceptible or swelling soils due to freeze-thaw cycles). It was also observed that flexible and rigid pavements constructed on active roadbed soils have the highest mean initial roughness values and the highest rates of deterioration relative to pavements constructed on fine- and coarse-grained roadbed soils. The findings of this study were in agreement with the findings of Simpson et al. (1994) and Khazanovich et al. (1998) that a good working platform (stabilized base and granular subgrade) contributed to a smoother pavement after construction.

2.16.2.3 Joint Load Transfer

A common finding from the studies by Simpson et al. (1994), Khazanovich et al. (1998), and Selezneva et al. (2000) is that the presence of dowel bars had a significant impact on reducing joint faulting. In fact, after 10 years in service, JPCP sections with dowel bars showed 50 percent less joint faulting than those without dowel bars. In wet and/or freeze climates, the use of dowel bars appeared to negate the effects of cold temperatures and increased moisture that can often lead to erosion and pumping of fines. Selezneva et al. (2000) also found that the usage of doweled joints can have more impact on pavement performance than design features such as sub-drainage, tied-concrete shoulders, and joint spacing. Further, Hall et al. (1997) found that properly sized dowel bars can eliminate corner breaks and transverse cracking near the joints as well as minimize joint faulting.

In an FHWA report authored by Stubstad et al. (2002) the impacts of various parameters on the variability of the load transfer, as quantified by the load transfer efficiency (LTE), measured over time were documented. They stated that:

- For un-doweled JPCP joints, the variability of LTE along a pavement section is inversely correlated to the average LTE. As the average LTE of a pavement section increases, the variability decreases.
- The LTE variability is not affected by joint spacing, base type, or shoulder type (PCC or AC).
- The LTE variability is higher in pavements with subsurface drainage systems than in pavements without subsurface drainage systems.
- The variability of the average LTE for pavements with granular roadbed soils is higher than that of pavements with silty clay roadbed soils.
- The variability of the average LTE is not affected by the amount of annual precipitation, the number of annual freeze-thaw cycles, or the average mean annual temperature.
- The variability of the average LTE decreases as the annual freezing index increases.
- No direct relationship was found between pavement age and the variability of the average LTE measurements over time.
- The variability of the average LTE is higher in pavements with tied concrete shoulders than in pavements with an asphalt shoulder.

2.16.2.4 Drainage

In a National Cooperative Highway Research Program (NCHRP) Research Results Digest, Harrigan (2002) stated that, for properly designed doweled joints in JPCP, joint faulting is fairly low and permeable bases have relatively small effect on reducing joint faulting. Edge drains were found not to have a significant effect on joint faulting when dense-graded bases were used. For non-doweled JPCP, joint faulting in general was higher and permeable bases have a significant effect in reducing joint faulting. However, the permeable bases should be designed and maintained to reduce or eliminate the migration of fines from the lower materials. Similarly, slab cracking was found to be reduced in pavements constructed on asphalt treated permeable base. D-cracking was also found to be less prevalent in pavement sections constructed on permeable bases; likely due to reduced base saturation and introduction of water and various compounds into the concrete slab. Note that all of these findings are based on limited data.

2.16.2.4 Base Type

In separate studies sponsored by FHWA and conducted by Khazanovich et al. (1998) and Titus-Glover et al. (1998), it was reported that JPCP constructed over a stabilized base had less faulting and smoother surface than those constructed with an untreated aggregate base, especially in un-doweled JPCP. JPCP with an asphalt-stabilized base or lean concrete base had significantly lower initial roughness when compared to other base materials. In addition, JPCP sections constructed with granular and asphalt-stabilized bases had significantly lower percentages of cracked sections than JPCP with cement-treated or lean concrete bases. The cracking was not associated with an increased roughness.

In a LTPP sponsored study conducted by Jiang et al. (2005) using the SPS-2 experiment data, it was found that pavement sections with permeable asphalt-treated base developed the fewest transverse and longitudinal cracks. On the other hand, pavement sections with lean concrete base developed the most transverse and longitudinal cracks during the first 10 years of pavement service life. This confirms the finding reported by Khazanovich et al. (1998) and Titus-Glover et al. (1998).

2.16.2.5 Slab Width

Khazanovich et al. (1998) and Selezneva et al. (2000) concluded that increasing slab width by 0.6 meters (2 feet) reduces faulting of concrete pavements by reducing the critical deflections at the corner of the slab from heavy truck axles. The mean faulting data for un-doweled sections (10 years old or less) indicate about 50 percent less faulting with a widened slab. It was stated that this outcome agrees with previous non-LTPP field performance data. No difference was found between the faulting of doweled widened slab sections and doweled conventional-width JPCP. However, JPCP sections with widened lanes did not show any transverse cracking. Additionally, the initial evaluation done by Jiang et al. (2005) on SPS-2 data revealed that widened slabs have less initial roughness.

CHAPTER 3

PAVEMENT CONDITION CLASSIFICATION

3.1 Foreword

In order to address the objectives of this study, as described in Chapter 1, a dual pavement rating system was developed which considers both the pavement condition and its rates of deterioration. The rationale for the development of the system is expressed in Chapter 2 and further detailed in this section. An accurate pavement condition rating system represents pavement behavior best when based on the current and future pavement conditions. The main benefit of including the estimation of future conditions is the ability of pavement managers to plan, budget, and create long-term treatment strategies to preserve the pavement network. Pavement condition ratings based on the current conditions alone only allow for decisions to be made for the given data collection cycle. The MAP-21 (Moving Ahead for Progress in the 21st Century) Act of 2012 sets forth the following directive for asset management:

"Asset management is a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost." *(85)*

The two key statements in the act are:

1. ***"Asset management is a strategic and systematic process of operating"***.

   A strategic and systematic process implies the ability to model and estimate future conditions and times for corresponding actions on a regular basis.

2. ***"Identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets".***

   The sequence of maintenance, repair, and rehabilitation implies current and future actions. Hence, accurate prediction of future conditions and timing of future actions are essential to the implementation of MAP-21.

The measured pavement distresses and conditions generally increase over time as the pavement deteriorates due to traffic loads and environmental conditions. Periodically over the pavement life cycle, preservation and rehabilitation treatments are applied to reduce the pavement distresses and improve its conditions, as illustrated in Figure 3.1. The costs of these treatments generally increases as the pavement deteriorates and the distresses or conditions worsen. Pavement condition rating based on current distresses and conditions are most commonly found to be problematic because it does not include the pavement rates of deterioration. The current condition alone does not support LCCA. Two pavement sections in equally good condition this year may or may not be in similar good or fair condition two or three years later. Consequently, an accurate pavement rating system should include the current distresses and conditions as well as the pavement rates of deterioration. Figure 3.2 illustrates the progression of roughness, as described by the IRI, of LTPP SPS-1 test sections 0102 and 0103 in the state of Iowa. The figure also provides an example rating system based on the current condition (IRI value). The data in this figure indicates that:

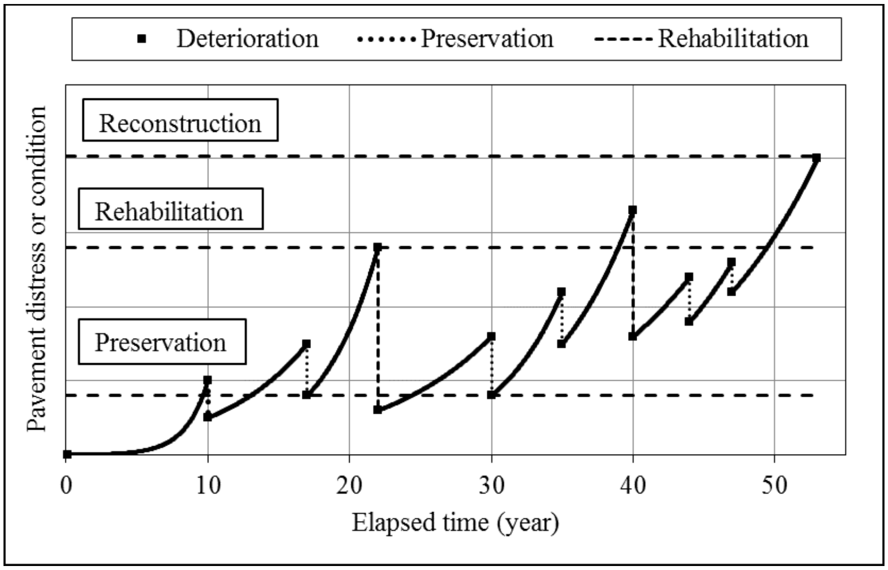


Figure 3.1 Typical pavement condition or distress over the pavement life cycle

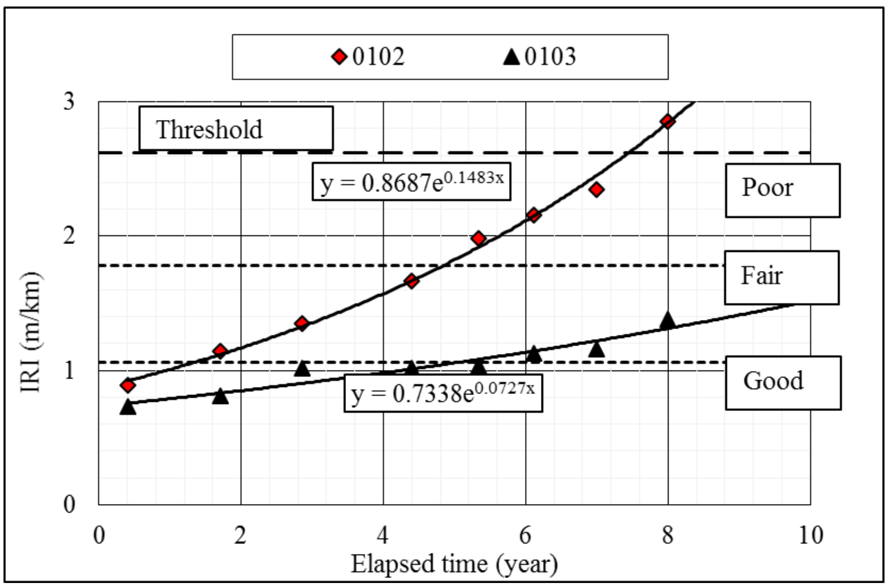


Figure 3.2 IRI versus elapsed time, SPS-1 test sections 0102 and 0103, state of Iowa

1. The initial IRI values for sections 0102 and 0103 are respectively about 0.9 and 0.7 m/km (55 and 45 inch/mile (good condition)).
2. The IRI values in the third year are about 1.3 and 1.0 m/km (63 and 85 inch/mile) for test sections 0102 and 0103 indicating good and fair condition, respectively.

3. Approximately two years later, the IRI of test section 0102 is more than 2 m/km (more than 120 inch/mile (poor condition)) whereas the IRI for test section 0103 is only about 1 m/km (65 inch/mile (good condition)).

The above observations indicate that test section 0102 moved from good to fair condition in about one year and from fair to poor in about four years. Whereas, eight years after construction, test section 0103 is in the middle of the fair condition. This example indicates that the latest measured IRI data of any test section should not be used alone to predict future condition and consequently to plan possible treatment actions. The time series data must be used. The reason is that almost all pavement sections deteriorate over time and their rates of deterioration vary substantially from one pavement section to the next. Hence, in order to effectively and comprehensively plan pavement preservation actions for a pavement network, the rate of deterioration with respect to each condition and distress type of each pavement section must be known. Therefore, an accurate pavement rating system should be based on each measured pavement condition and distress type and the corresponding rates of deterioration.

3.2 Pavement Condition Rating System

A balanced and comprehensive pavement condition rating system should be based on the two types of pavement conditions; functional and structural. In this study, the functional rating is based on ride quality (IRI) and safety (skid resistance and rut depth) and is expressed by the remaining functional period (RFP), (see definition below). For a given pavement section and when supported by the available data, three RFP values should be calculated; one based on IRI, one on rut depth, and one on skid resistance. The shortest of the RFP values will be assigned to the pavement section in question to flag the section for potential treatment actions.

The structural rating is based on cracking and rut depth or faulting, and is expressed by the remaining structural period (RSP), (see definition below). For any given pavement section, six RSP values should be calculated; one value for each of transverse, longitudinal, alligator, edge, and block cracking, and one for either rut depth for flexible pavements or faulting for rigid pavements. The smallest of the six values will be assigned to the pavement section in question to flag it for potential treatment actions.

Based on the above, the RFP is defined as the shortest time period in years from the time of the last data collection to the time when a functional condition or distress reaches its corresponding pre-specified threshold value. Although, in this study, two RFP measures (IRI and rut depth) were used to define RFP, the pool of functional measures could be expanded by SHAs to include, as an example, skid resistance. Nevertheless, in this study, after calculating two RFP values (one for rut depth and one for IRI), the smallest value was assigned to the pavement section in question to flag the section. The other RFP value was retained in the database. The RSP, on the other hand, is defined as the shortest time period in years from the time of the last data collection to the time when a structural distress reaches its corresponding pre-specified threshold value. In this study, for each test section, six RSP values were calculated, and the smallest value was assigned to the pavement section in question to flag it for potential action.

Once again, the pool of structural measures used in this study for calculating the RSP values could be expanded by the SHAs. It is important to note that once a pavement section is flagged for potential action, all available functional and structural data should be downloaded and examined before a treatment strategy is selected. Finally, the recommended threshold values for each pavement condition and distress are presented in a later section in this chapter.

The above definitions indicate that the RFP and RSP are not combined condition indices. Each condition and distress type is analyzed separately and the results are retained for further analyses. It is the minimum of the RFP or RSP values assigned to the pavement section that will flag the section for potential actions. Additionally, the RFP and RSP do not indicate the treatment to be applied to a pavement section. Rather, they are flagging mechanisms for identifying pavement sections that are in need for further attention. Once again, the stakeholder should review all available data for the flagged pavement sections and examine the distress and condition and other related data. After such examination, the stakeholder can select treatment alternatives that will address all or most defects and their causes. Ideally, each treatment alternative should then be subjected to LCCA and its impact on the entire pavement network should be determined before the treatment is selected.

The RFP and RSP concept differs from the condition indicators evaluated in Chapter 2. The RFP and RSP account for the pavement rates of deterioration. The RFP and RSP are calculated based on non-linear mathematical functions which model the progression of the condition or distress over time. These equations are flexible and can be selected by the users or they can be replaced by the equations of their choosing.

The RFP and RSP are a dual rating system; the RFP can be considered as a pavement rating for the users, whereas the RSP is an agency rating. The rating scale of the dual rating systems and the corresponding descriptive terms are listed in Table 3.1. The scale is divided into three condition states (CSs) numbered 1, 2, and 3 that correspond to poor (red), fair (yellow), and good (green) conditions, respectively, and to the three RFP and RSP ranges listed in Table 3.1. Finally, the main reason for using the same ranges in years for RFP and RSP is for ease of communication.

Table 3.1 Pavement condition rating based on three condition states

Condition State			RFP Range (Year)	RSP Range (Year)
Code	Color	Descriptive		
1		Poor	< 4	< 4
2		Fair	4 to < 8	4 to < 8
3		Good	≥ 8	≥ 8
The dual rating systems could be used to select treatment categories at the network level. For example, preservation treatments should generally be applied to pavement sections in fair or better condition states. Heavy preservation treatment, or more likely rehabilitation, should generally be applied to pavement sections having poor RSP condition states. The treatment selection should be verified at the project level.				

The dual rating system listed in Table 3.1 was expanded to the five CSs dual rating system listed in Table 3.2. The main advantage of the five rating system is that the condition of the pavement sections in one CS or within a given RFP or RSP range are more uniform. It is recommended that the three rating system be used for communication while the five rating system be used for analyses and management. Note that this is possible because the poor and good ratings of the three CS system encompass the two additional CSs from the five CSs system, while the fair CSs are equivalent.

The main advantage of the RFP and RSP is that the value of each should decrease one year for every calendar year. That is the RFP and RSP are linear functions of time although they are modeled as non-linear functions of the pavement distress and conditions. To illustrate this point, consider the power function (see Equation 3.1) that is typically used to model the rut depth data as a function of time.

$$RD = \alpha \times t^{\beta} \qquad \text{Equation 3.1}$$

The time at which the rut depth equal to the pre-specified threshold value (Th) can then be calculated using Equation 3.2.

$$t = \exp^{\left(\frac{1}{\beta}\right)\ln\left(\frac{Th}{\alpha}\right)} = e^{\left(\frac{1}{\beta}\right)\ln\left(\frac{Th}{\alpha}\right)} \qquad \text{Equation 3.2}$$

Table 3.2 Pavement condition rating based on five condition states

Condition State			RFP Range (Year)	RSP Range (Year)
Code	Color	Descriptor		
1a		Very poor	< 2	< 2
1b		Poor	2 to < 4	2 to < 4
2		Fair	4 to < 8	4 to < 8
3a		Good	8 to < 13	8 to < 13
3b		Very good	$\geq$ 13	$\geq$ 13

The time "t" in Equation 3.2 is constant and is equal to the time in years between the end of construction of the last treatment action and the time when the RD threshold value is reached. The RSP is then calculated as the time "t" minus the surface age of the pavement section in question as stated in Equation 3.3.

$$0 \leq RSP = (t - SA) = \left\{ e^{\left(\frac{1}{\beta}\right)\ln\left(\frac{Th}{\alpha}\right)} - SA \right\} \leq (DSL - SA) \qquad \text{Equation 3.3}$$

Where, RD = rut depth;

α and β of the non-linear function of Equation 3.1;

Th = threshold value for rut depth (typical value is 0. 5 inch (12.5 mm));

SA= surface age (year);

DSL = design service life of the last treatment (year);

ln = natural logarithm; and

e = exponential function.

Finally, the value of the RSP should be positive and is limited to the design service life minus the surface age of the pavement section in question. Such limitation is required until at least three time-dependent rut depth data are measured and are available in the database.

Since the time “t” in Equation 3.3 is constant, the RSP decreases by one year as the surface age of the pavement section increases by one year. To illustrate, consider the idealized rut depth power function of Equation 3.1 and the corresponding idealized data shown in Figure 3.3. The solid circles and curve in the figure simulate the idealized measured data whereas the dotted curve simulates the predicted rut depth data. At time zero (end of construction), no rut depth data are available and the RSP of the pavement section is equal to the design service life (DSL) of 15 years minus the pavement surface age (SA) of zero. Similarly, one and two years after construction the RSP is equal to the DSL minus the pavement SA. When the third measured rut depth data point becomes available, the data could be modeled using a power function and the time at which the rut depth reaches the pre-specified threshold value of 0.5-inch can be estimated using Equation 3.2. The RSP at that time is equal to the calculated time to threshold minus the pavement surface age. This procedure is repeated when a new data point becomes available and a new RSP value is calculated as displayed in Table 3.3. The RSP and SA values listed in Table 3.3 are plotted in Figure 3.4. It can be seen that the RSP decreases by one year as the SA increases by one year. Similarly, the IRI data measured as a function of time along LTPP test section 0102 in Iowa and depicted in Figure 3.5 (repeated herein for convenience), were modeled with an exponential function and six RFP values were calculated based on sets of three, four, five, six, seven, and eight time series data points. The results are listed in Table 3.4 and depicted in Figure 3.6. Once again, the actual measured IRI data when modeled using an exponential function yielded RSP values that decrease by one year as the pavement SA increases by one year. Once again, similar results were obtained from the analyses of other LTPP test sections using various cracking data. They are included in Chapters 5 and 6.

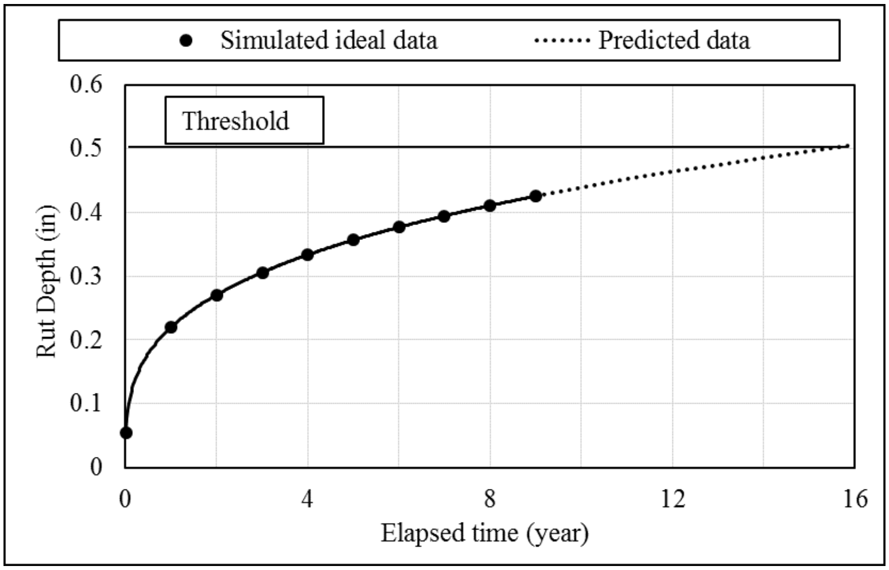


Figure 3.3 An example of idealized rut depth data and function versus elapsed time.

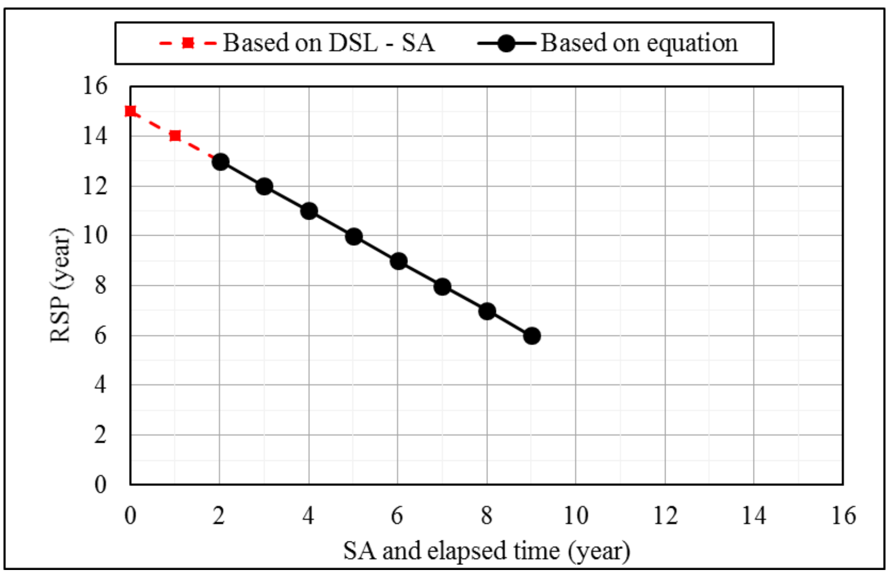


Figure 3.4 RSP versus the pavement surface age for an idealized power function.

Table 3.3 Progressive calculation of RSP of the idealized rut depth

Number of Available Data Points	Surface Age (Years)	Equation $RD = \alpha \times t^{\beta}$		RSP (Years)	Calculation Equation
		α	β		
1	0.01	N/A	N/A	14.99	$RSP = DSL - SA$ Assuming DSL = 15 years
2	1	N/A	N/A	14	
3	2	N/A	N/A	13	
3	2	0.2217	0.3	13	$RSP = \left\{ e^{\left[\frac{1}{\beta}\ln\left(\frac{Rut_{Th}}{\alpha}\right)\right]} \right\} - SA$
4	3	0.2217	0.3	12	
5	4	0.2217	0.3	11	
6	5	0.2217	0.3	10	
7	6	0.2217	0.3	9	
8	7	0.2217	0.3	8	
9	8	0.2217	0.3	7	
10	9	0.2217	0.3	6	

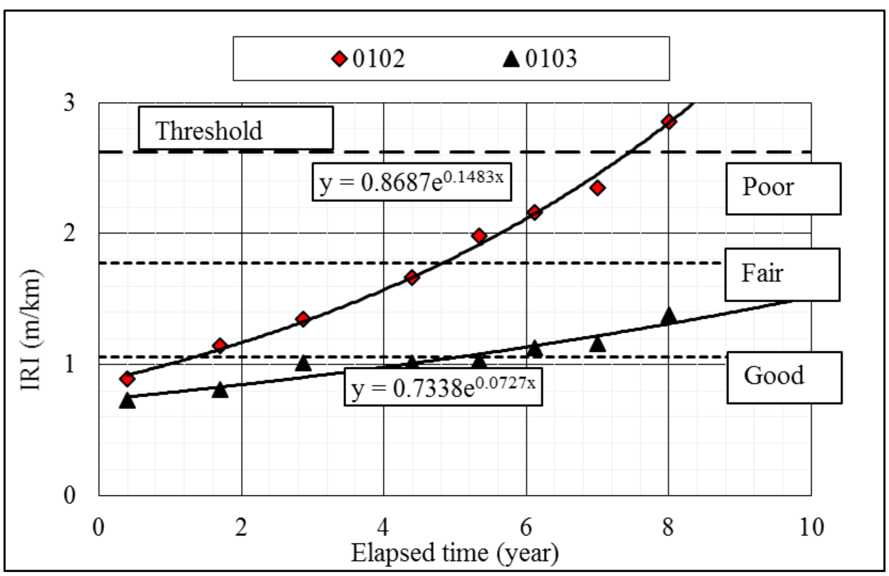


Figure 3.5 IRI versus elapsed time, SPS-1 test sections 0102 and 0103, state of Iowa.

Table 3.4 The RFP of test section 0102, state of Iowa, based on the IRI data listed below

Number of Data Points	Pavement Surface Age (Year)	IRI (Inch/Mile)	IRI		RFP (Year)
			α	β	$RFP = \frac{\ln\left(\frac{IRI_{Th}}{\alpha}\right)}{\beta}$
3	2.88	85.75	52.771	0.1721	3.99
4	4.32	103.62	53.864	0.1559	3.13
5	5.37	122.53	54.067	0.1535	2.17
6	6.13	136.45	54.251	0.1518	1.47
7	6.98	146.89	54.933	0.1464	0.82
8	8	180.64	54.721	0.1478	-0.25

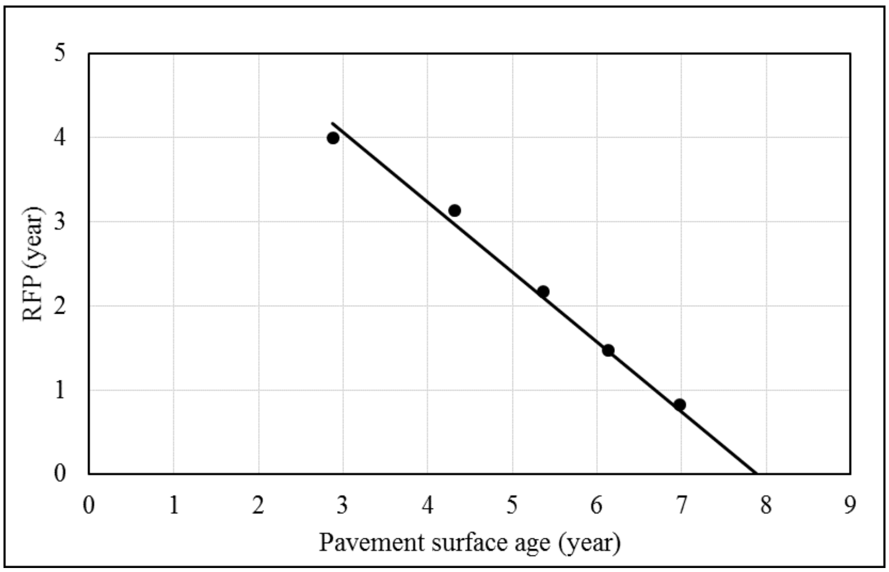


Figure 3.6 RFP versus pavement surface age, test section 0102, state of Iowa.

Nevertheless, the three and five CSs systems in terms of RFP and RSP are depicted for an idealized and un-treated pavement section shown in Figures 3.7 and 3.8. The threshold values in the figures are 2.73 m/km (172 inch/mile) and 180 m^2 of alligator cracking per 0.1 km (3,168 ft^2 of alligator cracking per 0.1-mile long pavement section), respectively. In addition, the RFP and/or the RSP can be used to express the rating of a pavement section or a pavement network during its entire life cycle, as depicted in Figures 3.9 and 3.10. The two figures show that the RFP and RSP increase slightly with the application of each preservation treatment and they increase significantly with rehabilitation. The initial values of the RFP and RSP after treatment,

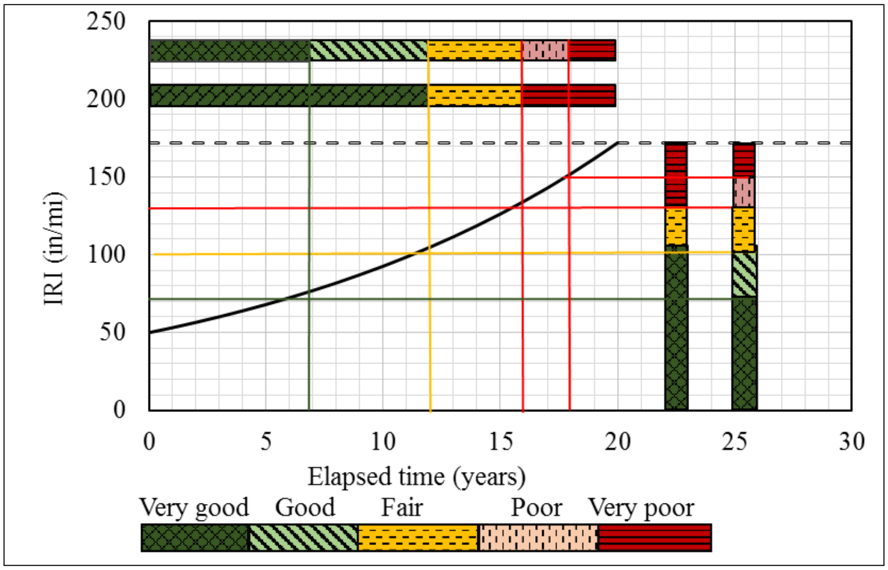


Figure 3.7 RFP condition states

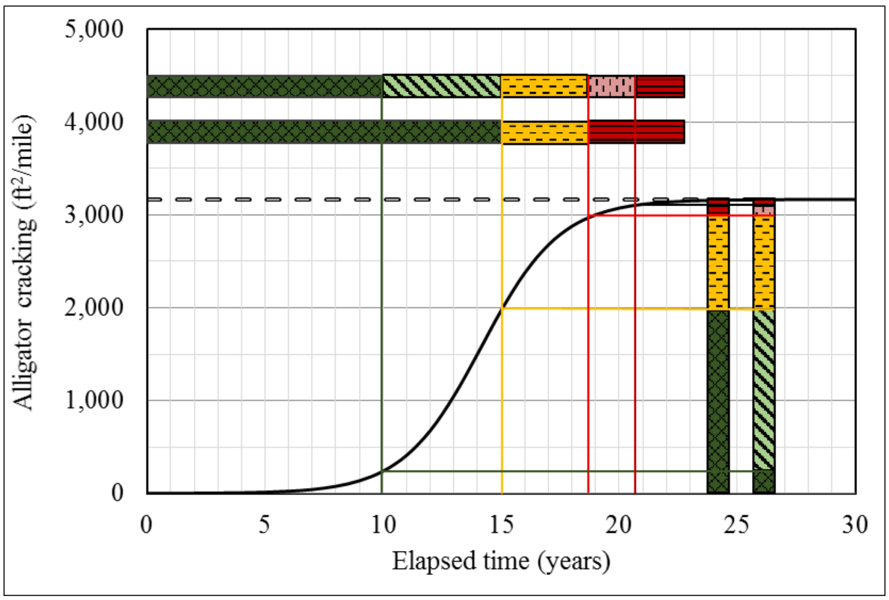


Figure 3.8 RSP condition states

and before condition survey is conducted, is the average expected performance period of that treatment. Hence, the RFP and RSP can be used as input for analyses of the life cycle costs, for the selection of an optimum and cost effective pavement preservation strategy, and for communications with engineers, managers, legislators, and the general public.

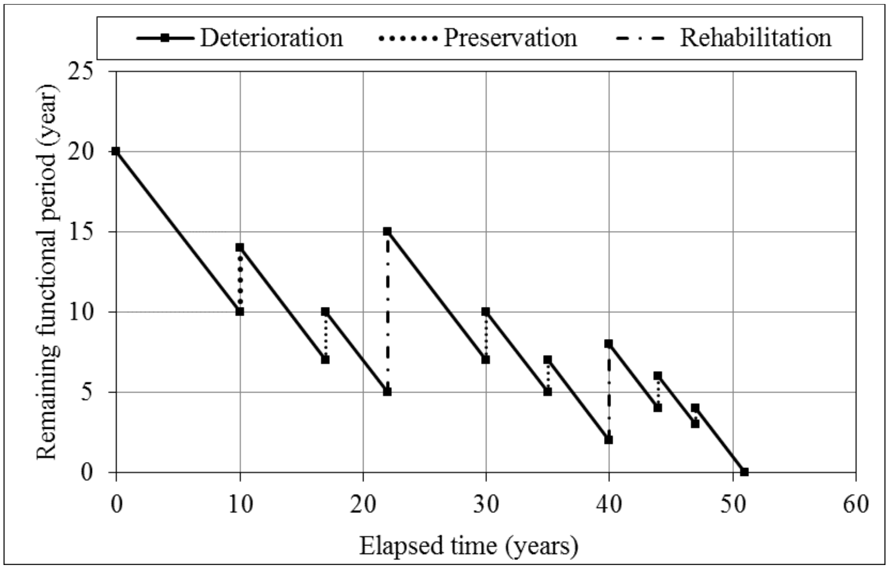


Figure 3.9 Typical RFP over the pavement life cycle

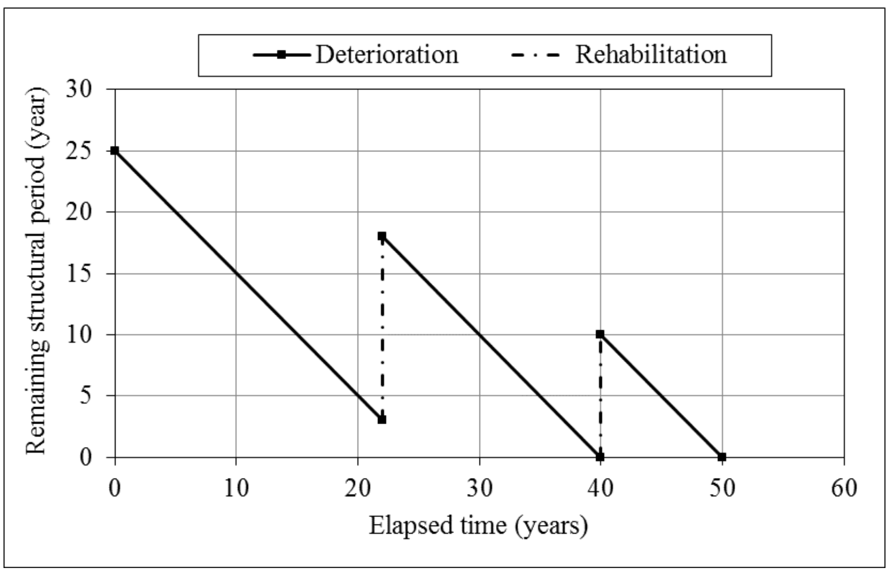


Figure 3.10 Typical RSP over the pavement life cycle

The RSP concept and the benefits of preservation treatments can be demonstrated by considering a flexible pavement section that was designed and constructed to last 15 years (DSL = 15 years). After construction, the section was in very good condition (the RSP was estimated at 15 years).

Over time, the section deteriorated (starts showing some cracks) and the pavement conditions dropped from very good to good in 6 years and to fair in 10 years as shown in Figures

3.11 and 3.12. When the pavement condition reached fair status (RSP = 5 years), a thin (less than 2.5-inch) HMA overlay was applied and the pavement surface condition was restored to very good. Over the next seven-year period, the pavement surface condition deteriorated again from very good to good and to fair. At 17 years after the original construction, another thin overlay was applied and the surface condition was restored to very good status. Five years after the second overlay, the pavement surface condition dropped from very good to good, at that time (22 years after construction), the section was subjected to thin mill and fill treatment and the pavement surface condition was restored once again to very good condition. To summarize, the first HMA overlay was applied 10 years after the original construction (when the condition of the pavement surface reached the fair condition state). A second overlay was applied when the surface of the first overlay reached the fair condition state. Finally, a thin mill and fill treatment was applied when the second overlay treatment was still in good condition. As illustrated in the figures, the HMA overlays provided a better surface condition initially and decreased the rate of deterioration of the lower (the original HMA layers). Indeed, the original asphalt layer is still in fair condition 22 years after construction.

It should be noted that, the timing for the first and second overlay or any other treatment type should be selected after LCC analyses is conducted. Any pavement section can be treated at any time during its service life. Some sections may be treated when the RSP is 15 years while others when their RSP is 8, still others when the RSP is at 3 years. Once again, the time and the type of the treatment should be selected based on the results of the LCC analyses. In this regard, the required data for the LCC analyses are:

1. For each applicable treatment type, the costs of the treatment when the pavement section is in each of the five condition states.

2. The expected treatment life (the time in years until the pavement condition after treatment reaches the same status as that before treatment).

The preferred treatment type(s) and time of treatment are those that yield the minimum cost and maximum benefits.

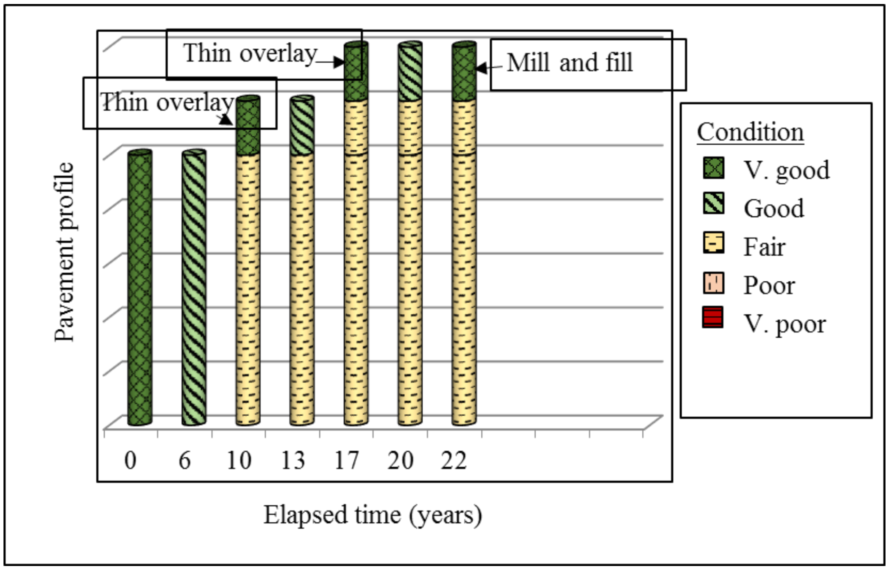


Figure 3.11 An example of pavement condition over time with two thin HMA overlays and one thin mill and fill action.

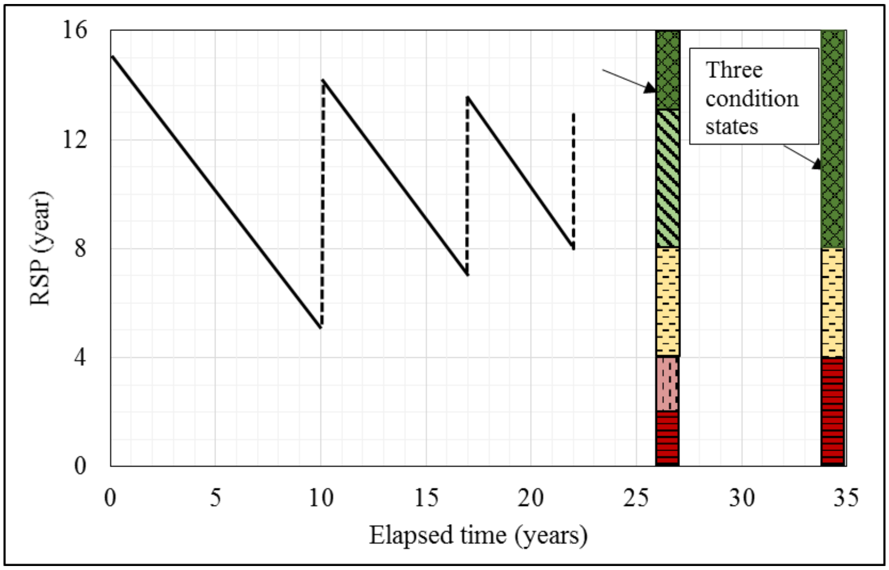


Figure 3.12 Example RSP over time with two thin HMA overlays and one mill and fill action.

3.3 Recommended Threshold Values

Threshold values are defined herein by the magnitude of a measurable pavement condition or distress which constitutes the minimum level of pavement functionality acceptable to the agency and users or the minimum acceptable level of structural integrity. All threshold values should be established based on certain engineering criteria of some pavement performance measures. For example, functionality thresholds should be established relative to ride quality and safety (such as IRI, skid resistance, and rut depth). Whereas, structural thresholds should be established relative to each cracking type, rutting or faulting. The units of measurement for the threshold values should be the same as those used in measuring the corresponding pavement condition and distresses. The engineering criteria for the threshold should include the impacts of their values on pavement condition and distress, the life cycle cost, and the optimum timing for pavement preservation. The recommended threshold values for the calculation of RFP and RSP are listed in Tables 3.5 and 3.6. The reasons behind the selection of the recommended values are presented in each table. Please note that the recommended threshold values are flexible and can be adjusted based on the agency and user needs and constraints and on the posted speed limit or road class.

The threshold values listed in Table 3.5 are representative of the average minimum level of serviceability which the SHAs strive to provide their users. Therefore, these values are somewhat subjective; where one SHA may strive to provide pavement with no more than 150 in/mi IRI, and another may set the maximum acceptable pavement roughness at 225 in/mi IRI for their pavements. Neither value is wrong, right, or otherwise, the value should be determined by the SHA by considering the user’s needs and expectations as well as the practicality and the life cycle costs associated with maintaining their pavement network given the agency constraints. Safety related threshold values such as rut depth and skid resistance, should also be determined by the SHA based on an assessment of the typical driving conditions, speeds, and vehicle

Table 3.5 Threshold values describing the RFP.

Pavement Condition Type	Threshold Values Used in the Analyses		AASHTO MEPDG Manual of Practice [86]
	Threshold Value	Explanation	
IRI	1.7 m/km (172 in/mi)	Minimum acceptable ride quality at 90 km/hr (55 mi/hr); driver speed and comfort may be reduced above this value	Interstate: 160 in/mi Primary: 200 in/mi Secondary: 200 in/mi
Skid resistance	To be determined by the agency	Depends on the method of measurement and pavement type	Not included
Rut depth	12.7 mm (0.5–in)	Maximum allowable depth to control hydroplaning potential in wet conditions at 90 km/hr (55 mph)	Interstate: 0.40-inches Primary: 0.50-inches Others (<45 mph), 0.65-inches

Table 3.6 Threshold values describing the RSP.

Pavement Condition or Distress Type	Threshold Values Used in the Analyses		AASHTO MEPDG Manual of Practice
	Threshold Value	Explanation	
Alligator cracking	73 m^2/0.1 km (1,267 ft^2/0.1 mile)	20 percent of the lane area cracked (assuming 3.66-meter lane width)	Interstate: 10% lane area Primary: 20% lane area Secondary: 35% lane area
Longitudinal cracking	200 m/0.1 km (1,056 ft/0.1 mile)	Two cracks along the entire section length	Not included
Transverse cracking (JPCP))	50 m/0.1 km (264 ft/0.1 mile)	Two thirds of the slabs are cracked (assuming 4.88-meter long slab)	Interstate: 10% Primary: 15% Secondary: 20%
Transverse cracking (HMA)	67 m/0.1 km (350 ft/0.1 mile)	Lane is divided into 3.7-meter squares (12-foot squares), assuming 3.7-meter (12-foot) lane width and even crack spacing of 3.7 meter (12-foot)	Interstate: 500-ft./mi. Primary: 700-ft./mi. Secondary: 700-ft./mi.
Faulting	6.35 mm, average over 100 m (0.25 inch, average over 0.1 mile)	Dowel bars have likely sheared or concrete around dowels has deteriorated and may be spalled	Interstate: 0.15-inches Primary: 0.20-inches Secondary: 0.25-inches

characteristics and their role in a risk assessment analysis. For example, the potential for hydroplaning increases in wet climates, on roads with minimal cross-slope for surface drainage, and in areas with higher speed limits. The maximum allowable rut depth should be determined to provide reasonably safe travel for most roadway travelers in an economically feasible manner.

Further, the threshold values do not imply that the SHA must or should wait to take action until the pavement sections reach the threshold values, nor do they imply that a roadway must be closed to traffic if the threshold is surpassed. The threshold value is a management tool which helps planners and managers to evaluate, assess, and make reasonable and potentially cost-effective decisions regarding the conditions and serviceability of the pavement network.

On the other hand, the engineering criteria for most of the structural threshold values listed in Table 3.6 are much more difficult to establish for various reasons including:

1. The lack of sufficient long-term pavement performance databases that can be used to analyze the impact of the threshold levels on the life cycle cost and the health of the pavement network. The most critical information that is insufficient to support the analyses is cost data.
2. The engineering criteria or the threshold values affect the total yearly cost of preserving the pavement network.
3. The constraints of the road authorities regarding budget level, political pressure, increased demand, and increasing cost over time.
4. The relationship between the engineering criteria (the threshold values) and the road class. A typical highway authority manages several classes of roads that have various traffic demands. If different threshold values are established for different road classes, communicating the values becomes problematic.

Nevertheless, it is generally agreed upon by the pavement community that pavement preservation and maintenance actions applied over time are more cost-effective than allowing pavements to deteriorate until reconstruction is “required.” Reconstruction is rarely “required”, as pavements can be preserved indefinitely. The question lies in where the tipping-points occur between the economics of preservation, maintenance, and rehabilitation. Typical pavement structures are subjected to reconstruction after numerous cycles of pavement preservation, maintenance, and rehabilitation. The number of these cycles and the corresponding life cycle costs are functions of the employed pavement preservation strategy and on the timing of the various pavement preservation cycles.

The establishment of the RSP threshold values should be based on the assumption that the RSP value would flag the pavement sections for preservation actions at the proper time. For example, consider a flexible pavement section which has begun to develop block cracking (top-down type cracks) due to surface aging. Several surface treatments, such as mill and fill or HMA overlay, could reduce or eliminate the block cracking and its rate of propagation. If the threshold value for block cracking is set very high or if the RSP value is allowed to decrease to zero and beyond the threshold value, the block cracks will extend in depths and the cost-effectiveness of these treatments generally decreases until the conditions (the tipping point) for reconstruction is reached. This tipping-point could be when the cracks pass the mid-depth of the asphalt layer or when they penetrate the entire asphalt layer. The specific condition(s) where reconstruction becomes most cost-effective is dependent on many factors including:

- User Costs – User costs can be summarized into the travel costs associated with driver delay and the vehicle operating costs (fuel and vehicle wear). The magnitude of the user costs for a given pavement project has many factors including the type and length of traffic control and detouring, the conditions of the roadway, and the traffic volume.
- Availability of Funds – SHA funds are limited and some pavement projects have higher priority than others for various reasons. Hence, pavement treatments may be applied sooner

or later than “optimum” and the cost-effectiveness of the treatment may be affected. For example, a given pavement section may have reached the tipping-point, without budget constraints, the proper fix can be applied. With budget constraint (short funding) a less-expensive “stop-gap” treatment may be applied.

- Ancillary Work Required – Federal and State regulation and policy often require standardization of ancillary transportation items when a pavement project is undertaken. The requirements can be contingent on the type of work being performed. For example, a roadway reconstruction will require update of vertical and horizontal curves, bridge clearance, guard rails etc., while an HMA overlay may not require any ancillary updates.
- Pavement Location (urban or rural) – The location of the pavement segment affects the costs of equipment mobilization and worker travel. Likewise, the amount of traffic and the number of access points also affects the costs. Highly trafficked roadways may necessitate detour routes that require improvements to handle the increased traffic, while the cost of traffic control can also be affected by traffic volumes and the number of driveways and entrance/exit ramps present.
- Pavement Treatment Benefits – The benefit of a given treatment is dependent on many factors, such as the BT conditions and rates of deterioration, construction and material quality, and the anticipated traffic and environmental loading. The inherent variability in the materials and construction quality often yield differing treatment benefits within the boundaries of a given pavement project.

The idea of structural integrity thresholds is even further convoluted by the false thought that pavements which have reached the threshold value must be reconstructed. Some pavement sections will reach the threshold for structural integrity yet may provide acceptable level of service. For example, a concrete pavement which has 100% of slabs with two or more transverse cracks would likely be more cost-effective to reconstruct than to perform full-depth patching at each transverse crack. However, if the cracks are not faulted, the roadway may still have an acceptable IRI value. In this scenario, the pavement will have an RFP value of greater than zero while its RSP value is zero. The preferred alternative in this scenario would be to schedule pavement reconstruction for when the RFP reaches zero. In other words, zero RFP implies that action is needed but zero RSP does not necessarily imply that reconstruction is needed immediately. However, the latter is a function of the threshold value and the type of distress. For example, a typical pavement rut depth can be removed using certain treatments. However, if the rut is due to shear failure in the lower pavement layers, reconstruction may be required to eliminate the causes of rutting. Likewise, if the threshold value is set too high (for example, 100 percent alligator cracking) reconstruction may be required.

The concept of long-life pavement can also add an extra nuance to the RSP concept. The idea behind long-life pavement is to construct a significant pavement structure that will resist structural deterioration, due to traffic and environmental loading, throughout the pavement cross-section. Pavement deterioration in long-life pavement would be limited to near the pavement surface (upper couple of inches), which can be “perpetually” replaced (i.e. mill and fill treatment). In this scenario, the RSP is virtually constant as any structural deterioration is periodically repaired.

One last important note on the RFP and RSP values is the concept of negative RFP or RSP. A zero value implies that either the pavement is providing less than standard level of service or the pavement structure has deteriorated to the point (depending on the threshold value) where reconstruction may be the most cost-effective treatment option. Therefore, a negative value of RFP or RSP indicates the length of time that has passed since the above implication. This information is not of particular use to pavement managers, since a pavement section with zero or -5 years RFP or RSP yield the same conclusion, reconstruction or heavy rehabilitation may be needed. For this reason, the RFP or RSP value could be limited to zero. Note that there is no technical upper limit on the RFP or RSP values. However, the maximum value should be reasonably set based on the average design service life of the pavement structure.

Finally, the above discussions are primarily based on the use of data observed or measured to characterize the pavement surface. Unfortunately, the damage has already occurred by the time the distresses appear on the pavement surface. An early indicator of impending surface distress would support early actions and the selection of cost-effective pavement treatments. Such early indication could come from the pavement deflection data measured using a falling weight deflectometer (FWD). The measured deflection and the rates of change over time could indicate the beginning of pavement deterioration prior to surface manifestation.

3.4 Flexibility of the Pavement Rating Systems

The dual pavement condition rating systems are designed to be adaptable to the needs and constraints of the users. The dual systems are based on three types of information 1) time series pavement condition and distress data, 2) threshold values, and 3) applications of the results, which can be molded by any SHA to work for almost any data set and for many different tasks. The three information types are addressed below:

1. Data – The data of the dual condition rating systems are the pavement condition and distress types included in the development of the rating. Recall that the dual rating is based on both functionality and structural integrity. The user may decide how to describe the pavement function and structural integrity. For example, this report utilizes the IRI values to describe ride quality, as is used by the LTPP and most SHA. However, an agency may choose to use another measurement or index, such as the ride quality index (RQI) in place of IRI. The rating process would be essentially the same with different data.

Likewise, the pavement conditions and distresses used to comprise the functional and structural integrity rating could have a wide range from user to user. For example, this report utilizes IRI and rut depth to rate the pavement function and utilizes alligator, longitudinal, and transverse cracking, and either rut depth or faulting to describe structural integrity. However, an agency may choose to use only traffic load or wheel path related distresses such as alligator cracking and transverse cracking (rigid pavement). Finally, an agency may choose to include additional data which were not included in the ratings in this report (such as edge cracking and block cracking). The data elements collected by the SHAs are not consistent and some may have more or less available data for use in the dual rating systems.

For example, pavement surface friction data are not often available at the network level. However, a SHA with significant friction data may choose to include the data in their functional rating or in a safety rating system. The addition or subtraction of the rating systems data does not affect the process of the rating systems. The rating is based on the minimum RFP and RSP values respectively, regardless of the number of elements.

2. Thresholds – The dual pavement condition rating systems utilize pavement condition and distress threshold values and CSs. Both of these are flexible in nature and can be molded to fit the needs of any highway authority.

   a) The pavement condition and distress types and thresholds presented in Tables 3.5 and 3.6 are not set in stone. They are based on those values available in various literature, the state-of-the-practice of SHAs, and the experience and opinion of the research team. They can be modified and calibrated to the needs of the interested highway authorities. For example, the recommended IRI threshold value of 172 inch/mile listed in Table 3.5 is based on providing comfortable ride on roads with speed limits of 55 mile per hour or higher. An agency may choose a higher or lower value such as 150 or 200 inch/mile based on the road users' inputs or the managers of the agency and in some cases the legislators.

Similarly, the interested agency may choose to use different threshold values for the structural integrity. The recommended values, listed in Table 3.6, are based on "crack saturation" or the point where preservation treatments other than heavy rehabilitation or reconstruction are no longer cost-effective. These threshold values are highly variable and depend on numerous factors. Hence, the values are anticipated to be modified by the interested agencies based on their specific scenarios.

b) The ranges in years of the RFP and RSP listed in Table 3.1 and expanded in Table 3.2 are designed to describe both the pavement conditions and rates of deterioration and to provide sufficient time for planners and managers to scope pavement sections for the application of cost effective pavement preservation treatments. Again, the interested agency may choose to modify these ranges to fit their needs. For example, the RSP range in years for the poor rating of zero to less than four years is based on the required time to select, program, finance and bid a major rehabilitation or reconstruction project. That is, if a project has an RSP value of less than four years and it was selected for major rehabilitation, the time required to finish the paper work to approve, design, plan, finance, establish specifications, and bid the project varies from 2 to 5 years depending on the SHA. Hence, 4 years is recommended so that by the time of construction, the RSP is near zero. The above scenario implies that any interested SHA could modify the ranges of the rating scale to fit their needs and based on their own practice. However changes or modifications are made, the process of the rating systems would be essentially the same with different ranges of RFP and/or RSP.

3. Applications – The applications of the dual rating systems are open and unlimited. Since the terms good, fair, and poor and the corresponding colors green, yellow, and red are easy to interpret and can be understood by the majority of stakeholders. The public could be informed of the CSs of the entire network or specific routes or sections. Legislators could use the ratings to determine future funding levels and directives. Planners and upper managers could use the ratings to allocate funds or to select regions or routes for treatment. Pavement managers could use the ratings to "flag out" pavement sections for treatment or to assess the future needs of the pavement network. The specific uses of the dual rating systems are numerous and can be established by the interested agency.

    One word of caution is that the dual rating systems cannot be used alone for the selection of treatment categories unless the boundaries of these categories are established. Figure 3.13 depicts the classic S-shaped curve for alligator cracking (expressed in the figure as percent of the total area). The figure also shows the boundaries for three treatment categories as follows:

    1. Window 1 (W1) for do nothing or light maintenance where the extent of alligator cracking varies from 0.0 to 2 percent. This extent corresponds to RSP CS 3 (more than 8 years).
    2. Window 2 (W2) for potential preservation actions where the extent of alligator cracking varies from 2 to about 18 percent. This extent corresponds to RSP CS 2 from 4 to 8 years.
    3. Window 3 (W3) for potential heavy rehabilitation or reconstruction actions where the extent of alligator cracking exceeds 18 percent. This extent corresponds to RSP CS 1 from 0 to 4 years.

The final selection of the treatment category and treatment type within a given category should be accomplished after the actual pavement condition and distress data and results of the forensic investigation of the causes of distresses are carefully examined.

The above discussion implies that the RSP and RFP spectrum could be divided to various ranges to aid in the selection of pavement preservation type and estimation of cost. For example, an RSP value larger than 8 implies light maintenance, whereas RSP values between 4 and 8 implies preservation treatments (that is no preservation treatment should be applied to pavement section having an RSP value of less than 4 years). Finally, an RSP value of less than 4 years implies rehabilitation and/or reconstruction. The interested SHA could assign an average cost to each of these RSP ranges based on their cost data. When such cost estimates can be accomplished base on the ranges of RSP, the data will indicate that early preservation (at high RSP value) yields the least LCC.

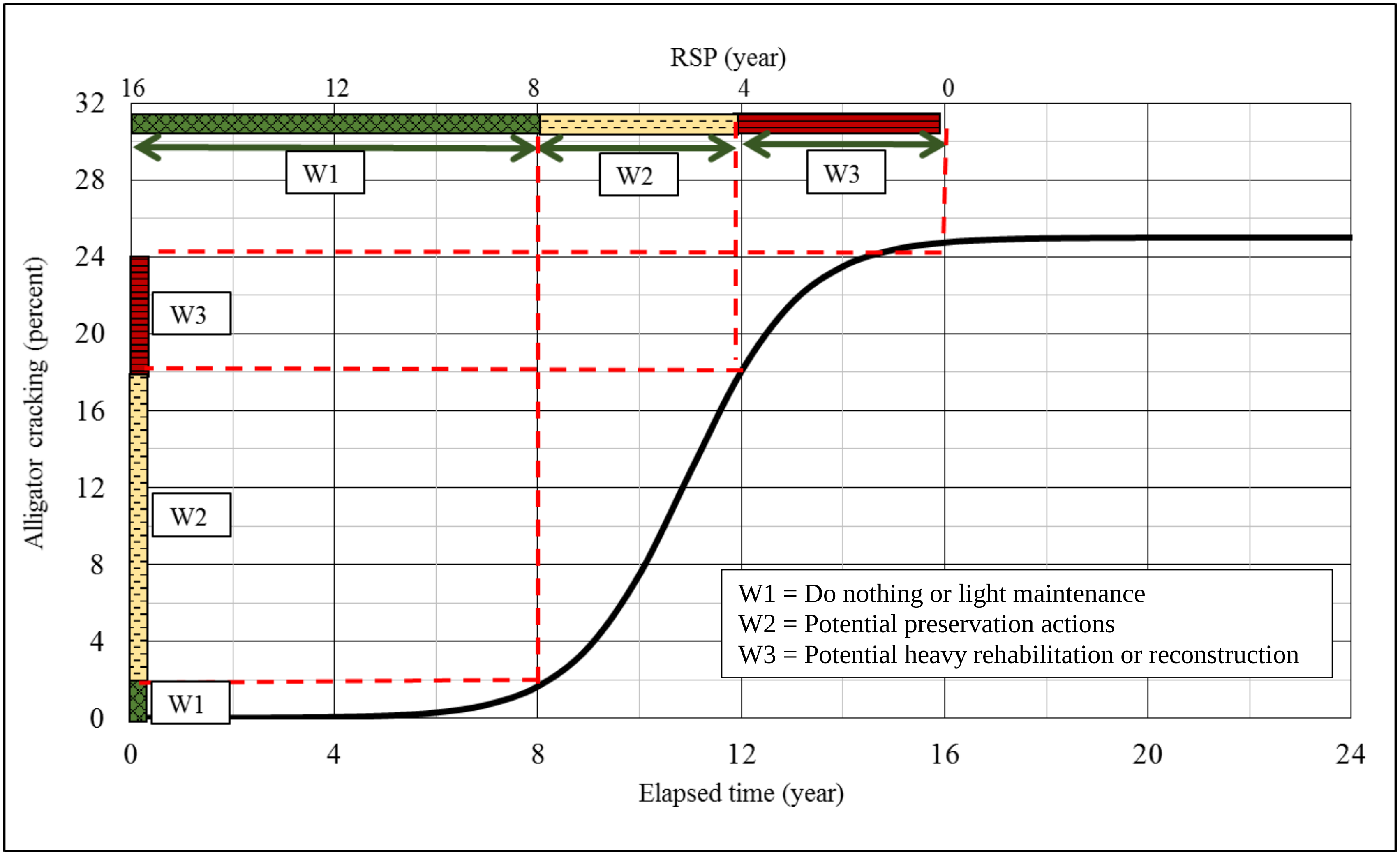


Figure 3.13 Idealized S-shaped curve for alligator cracking showing three windows (threshold values) for various treatment actions; W1 = Do nothing or light maintenance, W2 = Potential preservation actions, W3 = Potential heavy rehabilitation or reconstruction.

CHAPTER 4

DATA MINING AND SYNTHESIS

4.1 Data Sources

The data used in this study were obtained from the LTPP database standard release 28.0. The database contains six volumes consisting of the primary data set, data compilation views, FWD measurements, profile data, traffic data, and LTAS tables. Each of the six volumes contains various data elements for the more than 2,500 pavement test sections included in the LTPP program. While about 1,700 test sections have been de-assigned or de-commissioned from the LTPP program over time, nearly 800 remain active under the various experiments. Current planning and scheduling is taking place under the direction of the FHWA to establish additional experiments and test sections to study different/new topics. Tables 4.1 and 4.2 list the number of active test sections under each of the SPS and GPS experiments, respectively. The data from both active and de-assigned test sections were extracted from the database and arranged in special format for analyses. The detailed data extraction is presented in Sections 4.2 through 4.5 below. Results of the analyses are presented and discussed in Chapters 5, and 6.

Table 4.1 Active SPS test sections, as of January 2014

Number of active test sections in each SPS experiment										
SPS-	1	2	3	4	5	6	7	8	9	Total SPS
Number of test sections	53	186	0	0	53	18	0	59	43	412

Table 4.2 Active GPS test sections, as of January 2014

Number of active test sections in each GPS experiment										
GPS-	1	2	3	4	5	6	7	8	9	Total GPS
Number of test sections	13	8	67	16	30	174	51	0	13	372

Further, the pavement management databases from three SHAs; Colorado, Washington, and Louisiana were requested and received. From each database, several pavement projects were identified and their data were downloaded from the respective databases and formatted for analyses. Each of the selected projects was subjected to certain treatments in the past. The data for each project include the location reference systems, the time series pavement conditions and distresses, the time and types of treatments that were performed in the past, and in some cases, the cost of the treatments. The data were analyzed and the results of the analyses are presented in Chapter 7.

4.2 Automated and Manual Pavement Distress Data

The monitoring module within the primary data set of the LTPP database contains time series pavement distress data (rut depth, cracking, etc.) collected using manual (visual) and semi-automated (videotape) survey procedures. Table 4.3 provides a list of the number of manual and semi-automated surveys conducted for each test section in the SPS-1 experiment. The data for all other test sections in the SPS and all test sections in the GPS experiments are included in Appendix A. After detailed examination of the manual and the semi-automated pavement distress and condition data, the manual data were selected for data modeling and analyses. The semi-automated data were not used for the following reasons:

1. The number of available manual data points is much higher than that of the semi-automated data. The manual data have been collected over the entire duration of the LTPP program, while the semi-automated data were only collected between 1989 and 2004. Hence, less semi-automated data were collected.

2. The two sets of data are not compatible enough to be combined and analyzed as a function of time. The few semi-automated data points generally do not align with the trends indicated by the manual data over time.
3. The variability of the time series semi-automated pavement distress and condition data is much higher than that of the manual data. It is important to note that similar findings were also reported by Rada et al. 1999.

4.3 Data Extraction

In order to facilitate the analyses of this study, specific data items were extracted from the LTPP database and formatted for time series analyses. For each test section of the SPS and GPS experiments, the following data items were extracted from the LTPP database.

- Inventory
- The time series pavement condition and distress
- The time and type of pavement rehabilitation, preservation, and maintenance actions
- Traffic
- Climatic regions

4.3.1 Inventory Data

All inventory data including construction history of the test sections, their opening dates to traffic, lane widths, number of lanes, pavement layer types and thicknesses and subgrade information etc. were obtained from the inventory module. Some of the tables specifically used for this purpose were INV_AGE, INV_GENERAL, INV_ID, INV_LAYER, INV_SUBGRADE and so forth.

Table 4.3 Number of manual and semi-automated surveys for test sections in SPS-1 experiment

State (code)	Number of manual (M) and semi- automated (SA) surveys for test sections in SPS-1																							
	0101		0102		0103		0104		0105		0106		0107		0108		0109		0110		0111		0112	
	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA	M	SA
AL (1)	14	5	14	6	9	5	9	5	9	6	9	5	4	8	9	6	9	6	9	5	9	5	9	6
DE (10)	9	4	13	4	9	4	9	4	10	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4
FL (12)	10	2	10	2	10	2	10	2	10	2	10	2	10	2	10	2	10	2	10	2	10	2	10	2
IA (19)	7	7	6	7	5	7	6	7	6	7	6	7	7	7	6	7	6	7	6	7	6	7	6	7
KS (20)	3	2	3	2	8	7	7	7	8	7	8	7	3	2	8	7	8	7	8	7	8	7	8	7
NV (32)	26	6	8	6	8	6	11	6	8	6	11	6	11	6	11	6	11	6	11	6	11	6	11	6
NM (35)	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4
OH (39)	1	1	2	1	4	3	11	6	3	1	8	6	2	1	4	4	4	4	4	4	7	6	11	6
[redacted]	Number of M and SA surveys for test sections in SPS-1																							
	0113		0114		0115		0116		0117		0118		0119		0120		0121		0122		0123		0124	
AZ (4)	24	6	23	6	10	6	10	6	10	6	10	6	10	6	10	6	10	6	10	6	10	6	10	6
AR (5)	8	5	8	5	8	5	8	5	8	4	8	5	6	5	6	5	6	5	8	5	8	5	8	5
MI (26)	-	-	-	-	13	3	13	3	13	3	6	2	-	-	6	2	6	2	-	-	13	3	13	3
MT (30)	13	2	20	2	13	2	13	2	13	2	13	2	13	2	13	2	13	2	13	2	13	2	13	2
NE (31)	2	2	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
OK (40)	1	5	2	5	4	5	11	5	3	5	8	5	2	5	4	5	4	5	4	5	11	5	11	5
TX (48)	13	3	13	3	13	3	13	3	13	3	13	3	13	3	13	3	13	3	13	3	13	3	13	3
VA (51)	12	1	19	4	8	4	8	4	8	4	8	4	8	4	9	4	11	4	8	4	8	4	8	4
WI (55)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

4.3.2 Time Series Pavement Condition and Distress Data

The time series pavement condition and distress data utilized in the analyses include transverse (TC), longitudinal (LC), and alligator cracking (AC), rut depth, IRI, and faulting. These data were extracted from their respective files and reorganized in a spreadsheet format for analyses. The pavement condition and distress data were obtained from the following LTPP tables under the monitoring module of the LTPP database:

1. Cracking - MON_DIS_AC_REV, MON_DIS_CRCP_REV, and MON_DIS_JPCC_REV - The cracking data are classified and stored in the database utilizing three severity levels; low, medium, and high, as described by the LTPP Distress Identification Manual (Miller & Bellinger 2003). The difficulty with such data is that the crack severity rating is a function of several variables including:
   - The pavement temperature at the time of the distress survey. The crack width, which is part of the severity level assignment, is a function of the pavement temperature. In general, the crack width increases as the temperature decreases.
   - The subjective judgment of the surveyor who is reviewing and observing the cracks. Such subjective judgment is a function of the degree of training and experience of the surveyors. Further, the same pavement segment is likely to be surveyed by different surveyors over time. Thus, a crack may be labeled high severity in one year and medium the next year or vice versa. Figures 4.1 and 4.2 depict, respectively, the time series low, medium, and high severity transverse cracking data of SPS-3 test section A330 and SPS-5 test section 0502 in the state of California. Examination of the figures indicates that the sum of the time series low, medium, and high severity cracking data is more consistent over time than the individual severity levels of cracking and therefore more suitable for

modelling. Further, various attempts were made to analyze the data per severity level, in each attempt, the data for a significant number of test sections were eliminated from the analyses because of their high variability over time. In addition, the transverse cracking data are classified and stored in the LTPP database as either unsealed or sealed cracking at each severity level. While the longitudinal cracking data are classified and stored at each severity level as sealed and unsealed cracks in the wheel path or non-wheel path. The sealed and unsealed cracks have the same effect on the pavement structural integrity, the only difference is that sealed cracks retard water infiltration which may slow the rate of deterioration. Further, the wheel path and non-wheel path longitudinal cracks differ in their potential causes. Wheel-path longitudinal cracks in flexible pavement are likely to be either the start of top-down cracking due to pavement-tire interaction or the first appearance of alligator cracks on the pavement surface. In fact, for some test sections, the extent of longitudinal cracking, from one survey cycle to the next, decreases substantially as alligator cracking is recorded for the first time, indicating that the longitudinal cracks were re-classified as alligator cracks. Therefore, for flexible pavements, longitudinal cracking in the wheel path were combined with alligator cracking to facilitate the analyses of the data. Note that the selection of treatment type is based on the severity and location of the cracks, but the condition rating of the pavement is not affected by such information.

2. Roughness – MON_PROFILE_MASTER – The time series pavement roughness data are computed into IRI values and are stored in the database as left wheel path IRI and right

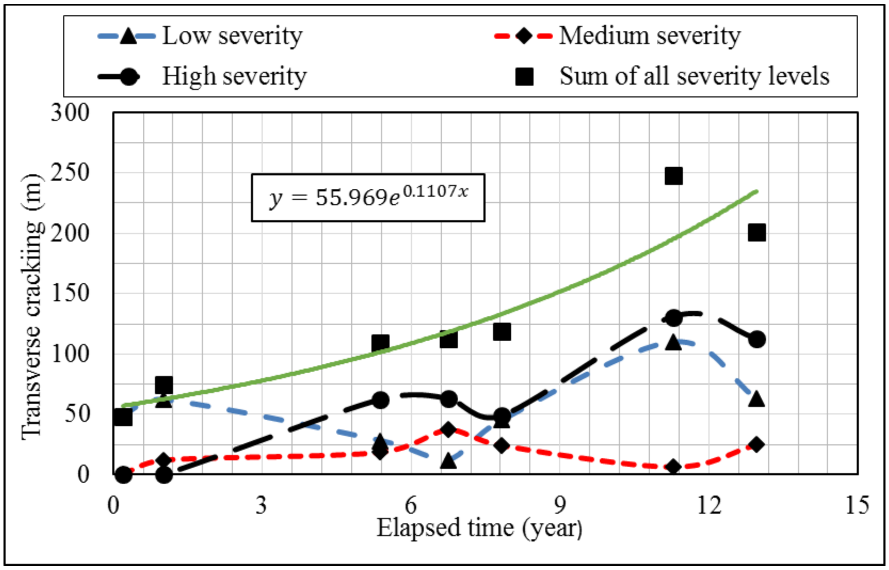


Figure 4.1 Transverse cracking versus elapsed time, SPS-3 test section A330, the state of California

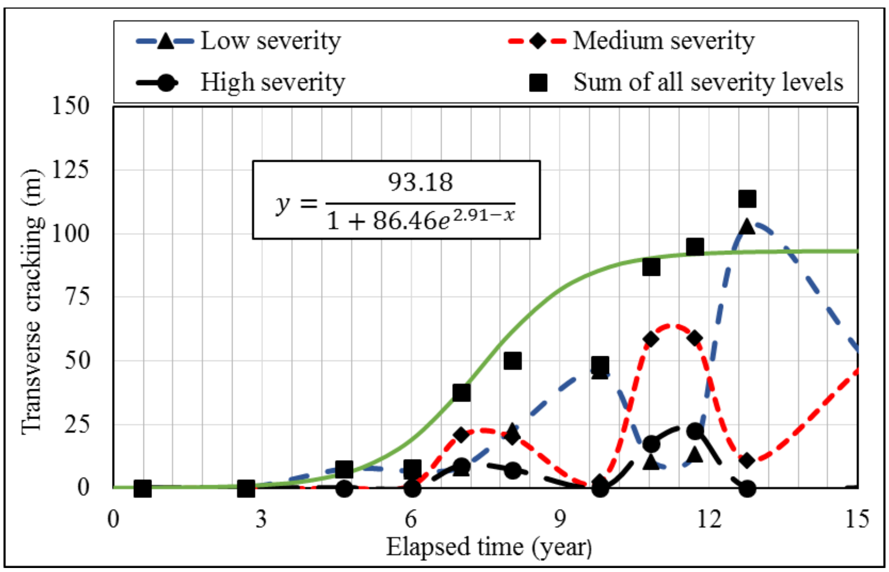


Figure 4.2 Transverse cracking versus elapsed time, SPS-5 test section 0502, the state of California

wheel path IRI. The average of the two values is considered equivalent to the effect of roughness on the traveling vehicle. Hence, the average value of the IRI was considered in the analyses.

3. Faulting – MON_DIS_JPCC_FAULT – For transverse joints, pavement faulting data are stored as edge faulting and wheel path faulting. The wheel path faulting data was used in the analyses since faulting at the edges could be influenced more by warping and/or curling.
4. Additionally, the average faulting among all joints within a given test section was calculated and used in the analyses.
5. Rut Depth – MON_T_PROF_INDEX_SECTION - In the initial stages of the LTPP program, rut depth measurements were made using a 1.2-m (4-ft) straightedge reference under the assumption that wheel path depressions are not wider than 1.2-m (4-ft). These rut depth measurements can be found in the MON_RUT_DEPTH_ POINT table. However, in many instances the wheel path depressions are wider than 1.2-m (4-ft). Hence, transverse profile measurements have been chosen by the LTPP program over straight edge measurements to account for this (Elkins et al. 2012). The transverse profile data was used by the LTPP program to calculate the mean and the maximum rut depth in each wheel path. The average of the two means and the average of the two maximum rut depth data were calculated and the former was used in the analyses in this study.

4.3.3 Pavement Rehabilitation, Preservation, and Maintenance Data

Pavement rehabilitation, preservation, and maintenance data were extracted from the MAINT_REHAB Module of the LTPP database. The treatments performed on the LTPP test sections were classified and stored under different tables namely MNT_IMP and RHB_IMP. After downloading the data, they were organized such that the treatment information of each LTPP test section can be easily retrieved and analyzed. For all LTPP test sections that received one or more treatments and for each treatment type, the pavement condition and distress data were organized in two different groups; before treatment and after treatment. Such grouping is crucial to accurately model the pavement performance before and after treatment and to estimate the treatment benefits.

4.3.4 Traffic Data

The traffic data for each test section were extracted from the traffic module of the LTPP database. The ESAL data in the table TRF_ESAL_COMPUTED were used to group the various test sections. The grouping were used to assess the impact of various variables on pavement performance, the longevity of the pavement sections, and the effectiveness of the pavement treatments.

4.3.5 Climatic Data

North America has been divided into four climatic regions; dry-freeze, dry-no-freeze, wet-freeze, and wet-no-freeze. The climatic regions were obtained from TRF_ESALS_INPUTS_SUMMARY table of the traffic module. The criterion established by the LTPP to identify wet and dry climates is based on annual precipitation. Regions having annual precipitation of less than 20 inches per year are considered dry. The classification of freeze or no freeze is based on the Freezing Index. Test sites located in regions where the annual Freezing Index is greater than 150 degree-days are considered to be in a freezing climatic region.

4.4 Status of the Condition and Distress Data

As stated in Section 4.3.2, for each LTPP test section in the SPS and GPS experiments, and for each pavement treatment type, all available BT and AT condition and distress data were downloaded and organized in spreadsheet format for analyses.

Table 4.4 provides a summary of the alligator, longitudinal, and transverse cracking data of all SPS-1 test sections located in the State of Montana (state code 30). Each row in the table represents one pavement test section. The columns indicate the treatment types and the number of pavement condition and distress surveys (number of time series data points) that have been conducted before and after each treatment. For example, test section 0113 was subjected to crack sealing, aggregate seal coat, and two additional crack sealing treatments since its assignment into the LTPP. The number 5 under the first BT column indicates that five time series data points (surveys) are available in the LTPP database before the first crack sealing treatment was applied. The number 2 under the AT/BT column indicates that there are two data points available in the database after the first crack sealing treatment and before the aggregate sealing treatment. The numbers under the other AT/BT columns indicate the number of data points available in the LTPP database after the previous treatment and before the next treatment. Finally, there are four time-series data points available in the LTPP database after the last crack sealing treatment. Note that the number of BT data points for the first crack sealing application and the number of AT data points after the last crack sealing treatment are greater than 3 and hence, the data can be modeled as a function of time.

A similar summary for each SPS and GPS experiment in each State can be found elsewhere. The information listed in Table 4.4 and others were used to identify the test sections and the treatments for which three- or more time-series condition or distress data points are available before and/or after a particular treatment.

4.5 Status of the Maintenance and Rehabilitation Data

As stated earlier, the maintenance and rehabilitation actions and their time of application were compiled for analysis. A summary of the number of test sections in the SPS and GPS experiments with and without treatments is listed in Tables 4.5 and 4.6.

Test sections in the SPS-1 through SPS-7 and GPS-6, GPS-7, and GPS-9 were included in the analyses to assess the impacts of design variables and treatment benefits. The available data for the untreated test sections were used as control sections or to estimate the service period of the test section.

4.6 Analyses Procedures

Most of the proposed analyses for the evaluation of the effectiveness of the various pavement treatments are based on the determination and evaluation of the relationships between the before and after treatment pavement performance. Such pavement performance is a function of the available time dependent pavement condition and distresses data and the corresponding rates of pavement deterioration. In order to model, with some degree of certainty, the condition and distress data over time using non-linear mathematical functions, a minimum of three time series data points are required before and/or after treatment. Two or fewer data points do not define the parameters of the non-linear mathematical functions representing the data. Examination of the available data points in the LTPP database indicates that, for a significant number of test sections, only two data points are available before and/or after treatment. In order to enhance the number of available data and to increase the number of test sections that can be analyzed, several methods were implemented in the analyses. These methods are presented below.

1. The addition of one data point immediately after certain treatments – Often times the pavement conditions and distresses were not measured immediately after construction or after treatment application. Depending on the treatment type, the condition and distress values after the construction of some treatment actions can be logically and reasonably assumed. Therefore, for all newly constructed SPS-1 and SPS-2 test sections and for all other test sections where AC overlay or mill and fill treatments were applied, one can reasonably assume that at 0.01-year (3 days) after construction, the initial value of the rut depth, faulting, and the total length of each crack type is negligible. Since 0.0 data point is not allowed in the mathematical functions used in modeling the data, the initial pavement distress and condition at the elapsed time of 0.01 year after construction were assigned the following values:

    a. Rut depth – 0.01 mm (0.01 inch for the state data)
    b. Transverse cracks – 0.01 m (0.01 ft for the state data)
    c. Longitudinal cracks – 0.01 m (0.01 ft for the state data)
    d. Alligator cracks – 0.01 m^2 (0.01 ft^2 for the state data)

   This assumption supports the addition of one extra data point that can be used in the analyses of pavement performance. Unfortunately, no initial value of IRI can be reasonably assumed. To illustrate, in the state of Oklahoma, skin patching has been applied to 12 SPS-1 test sections. The database contains more than three time series pavement condition and distress data points that were collected after the skin patching was performed but only two data points are available before the treatment. Since all SPS-1 test sections were newly constructed, one data point can be assumed indicating that at 0.01-year after construction, the magnitude of rut depth, crack length, and faulting are the same as those listed above.

Table 4.4 Number of cracking data points available before and after pavement treatments, SPS-1 test sections in the state of Montana

State (code)	SHRP ID	BT	Treatment type	AT/BT	Treatment type	AT/BT	Treatment type	AT/BT	Treatment type	AT
MT (30)	113	5	CS	2	ASC	1	CS	1	CS	4
	114	10	CS	3	ASC	2	CS	1	CS	4
	115	5	CS	2	ASC	1	CS	1	CS	4
	116	5	CS	2	ASC	1	CS	1	CS	4
	117	5	CS	2	ASC	1	CS	1	CS	4
	118	5	CS	2	ASC	1	CS	1	CS	4
	119	5	CS	2	ASC	1	CS	1	CS	4
	120	5	CS	2	ASC	1	CS	1	CS	4
	121	5	CS	2	ASC	1	CS	1	CS	4
	122	5	CS	2	ASC	1	CS	1	CS	4
	123	5	CS	2	ASC	1	CS	1	CS	4
	124	5	CS	2	ASC	1	CS	1	CS	4

CS = crack sealing, ASC = aggregate seal coat, BT = before treatment, AT = after treatment, AT/BT = AT for the previous treatment and BT for the next treatment

Table 4.5 Number of SPS test sections with available treatment data in the database

Treatment status	Number of sections for each SPS experiment number designation									
	1	2	3	4	5	6	7	8	9	Total
With treatments	163	106	408	192	202	169	38	13	102	1,393
Without treatments	82	101	37	28	2	1	1	40	35	327
Total	245	207	445	220	204	170	39	53	137	1,720

Table 4.6 Number of GPS test sections with available treatment data in the database

Treatment status	Number of sections for each GPS experiment number designation								
	1	2	3	4	5	6	7	9	Total
With treatments	197	121	96	56	50	50	27	12	609
Without treatments	36	23	37	13	35	15	8	13	180
Total	233	144	133	69	85	65	35	25	789

The addition of such data point makes the analyses of the BT pavement performance possible. Once again, such an assumption is reasonable and logical because for flexible pavements, the smooth-drum rollers that are typically used in the compaction of the original HMA or overlays or mill and fill treatments produce smooth and flat pavement surface with no rutting or cracking. The LTPP treatments which were considered for this action are listed in Table 4.7. This addition of a data point immediately AT was only applied to pavement segments where only two BT and/or AT data points are available. If less than two data points are available, the procedure will not yield three data points and hence it was not used. The addition of such data point significantly enhanced the number of available pavement segments for analyses. Note that no data points were added to any pavement segment that was subjected to any other treatments not listed in Table 4.7.

Table 4.8 provides a summary of the status of the cracking data of all SPS-1 test sections located in dry-no-freeze region. The data in each of the designated columns are explained below. Similar tables for all pavement condition and distress data types and other LTPP experiments and climatic regions are included in Appendix B of this report.

- Column A – The climatic region.
- Column B – The state and state code.
- Column C – The treatment type.
- Column D – The number of SPS-1 test sections.
- Column E – The number of times treatments were applied. When the number in column E is higher than the number in column D, it implies that at least one test section received the treatment more than one time.

- Column F – The number of treatment applications where three or more time series data points are available before and after treatment.
- Column G – The number of treatment applications where three or more time series data points are available before treatment only.
- Column H – The number of treatment applications where three or more time series data points are available after treatment only.
- Column I – The number of treatment applications where one data point can be logically assumed immediately after treatment (see item 1 above) that yields three time series data points before and after treatment.
- Column J – The number of treatment applications where one data point can be logically assumed immediately after treatment (see item 1 above), which make three time series data points before treatment only.
- Column K – The number of treatment applications where one data point can be logically assumed immediately after treatment (see item 1), which make three time series data points after treatment only.
- Column L – The number of test sections that can be analyzed before and after treatment.
- Column M – The number of test sections that can be analyzed before treatment only.
- Column N – The number of test sections that can be analyzed after treatment only.

There are 1,555 LTPP test sections (supplemental sections are not included) in the SPS-1 through SPS-7 and in GPS-6, GPS-7, and GPS-9 experiments. The majority of these sections (1,301) were treated at least one time during their assignment period. The total number of treatment applications is 2,674 (some test sections received more than 1 treatment). For new construction (SPS-1 and SPS-2 test sections) and for overlay and mill and fill treatments, one rut depth, cracking length, and faulting data point was added at 0.01-year after construction.

After the addition of this data point, the number of test sections that can be analyzed before and after treatment, the number of sections that can be analyzed before treatment only,

Table 4.7 Condition or distress type eligible for data addition for different treatments

Pavement treatment type	LTPP treatment code	Pavement condition or distress type eligible for data addition					
		IRI	Rut depth	Longitudinal cracking	Transverse cracking	Alligator cracking	Faulting
Grinding surface	12	-	-	-	-	-	✓
Reconstruction (removal and replacement)	18	-	✓	✓	✓	✓	✓
Asphalt concrete overlay	19	-	✓	✓	✓	✓	✓
Portland cement concrete overlay	20	-	NA	✓	✓	NA	✓
Surface treatment, single layer	28	-	-	✓	✓	✓	-
Surface treatment, double layer	29	-	-	✓	✓	✓	-
Surface treatment, three or more layers	30	-	✓	✓	✓	✓	-
Aggregate seal coat	31	-		✓	✓	✓	-
Hot-mix recycled asphalt concrete	43	-	✓	✓	✓	✓	✓
Cold-mix recycled asphalt concrete	44	-	✓	✓	✓	✓	✓
Heater scarification, surface recycled asphalt concrete	45	-	✓	✓	✓	✓	✓
Recycled Portland cement concrete	48	-	NA	✓	✓	NA	✓
Mill off AC and overlay with AC	51	-	✓	✓	✓	✓	✓
Mill off AC and overlay with PCC	52	-	NA	✓	✓	NA	✓
Mill existing pavement and overlay with hot-mix recycled AC	55	-	✓	✓	✓	✓	✓
Mill existing pavement and overlay with cold-mix recycled AC	56	-	✓	✓	✓	✓	✓
NA = Not applicable, and - = Not eligible for data point addition							

Table 4.8 Summary of cracking data for SPS-1 test sections located in the dry-no-freeze region

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Climatic region	State (code)	Treatment data		Number of treatment applications							Number of treatment applications that can be analyzed before and after treatment		
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)					
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry- no-freeze	AZ (4)	CS	6	8	2	4	2	0	0	0	2	4	2
		FDP	1	1	0	1	0	0	0	0	0	1	0
		PHP	1	1	0	1	0	0	0	0	0	1	0
		SS	6	6	4	0	2	0	0	0	4	0	2
	NM (35)	GS	2	2	0	2	0	0	0	2	2	0	0
	OK (40)	MPSP	1	1	1	0	0	0	0	0	1	0	0
		SP	12	12	0	0	12	0	12	0	12	0	0
	TX (48)	ACOL	12	12	0	1	1	0	0	0	0	1	1
		ASC	11	11	0	0	0	0	0	11	0	0	11
		GS	3	3	0	0	3	0	3	0	3	0	0
		MOAC	12	12	12	0	0	0	0	0	12	0	0
		MPSP	11	11	0	11	0	0	0	0	0	11	0

ACOL - Asphalt concrete overlay; ASC - Aggregate seal coat; CS - Crack sealing; FDP - Full depth patching; GS - Grinding surface;
MOAC - Mill and overlay with AC; MPSP - Machine premix spot patching; PHP – Pot holes patching; SP - Skin patching; SS - Slurry seal; BT - Before treatment; AT- After treatment

and the number of sections that can be analyzed after treatment only are listed in Table 4.9.

Table 4.9 Summary of treatments applied to SPS-1 to SPS-7 and GPS-6, 7, and 9 that were analyzed in this study

Number of test sections	Number of treated sections	Number of treatment applications	Pavement distress/ condition	Number of treatment applications analyzed		
				BT & AT	BT only	AT only
1,555	1,301	2,674	Cracking	278	463	925
			IRI	468	558	911
			Rut depth	394	453	747
			Faulting	42	70	108
Total				1,182	1,544	2,691

2. Using the Control Section Data for BT Conditions – Several of the LTPP experiments, including SPS-3 through SPS-6, were designed with a control section (untreated) adjacent to the test sections (which were subjected to various treatment types). The control section was subjected to almost the same traffic and environmental loading and has almost identical structure and subgrade support characteristics. For this reason, the performance data of each control section can be used to represent the before treatment performance data of the adjacent test sections when only two or fewer BT data points are available in the database for the given test section. For example, SPS-3 test section A310 (see Figure 4.3) in the state of Maryland has only one cracking data point (not shown in the figure) collected before an overlay treatment was performed. There are six cracking data points available after the overlay was performed. To analyze the BT conditions of test section A310, the performance data of the control section A340 (see Figure 4.4), which was not subjected to treatment, was used to represent the A310 BT performance.

In some cases, where no control sections are assigned, the linked GPS test sections associated with the SPS sections were used as control sections (Hall et al. 2001). Linked GPS test sections are under the GPS experiment and are located adjacent to the SPS test sections. They have traffic loading and structure similar to the SPS test sections to which they are linked. Some of the linked GPS sections were also treated. However, the before treatment data (see Figure 4.5) can still be used as the before treatment data for the SPS-3 test section.

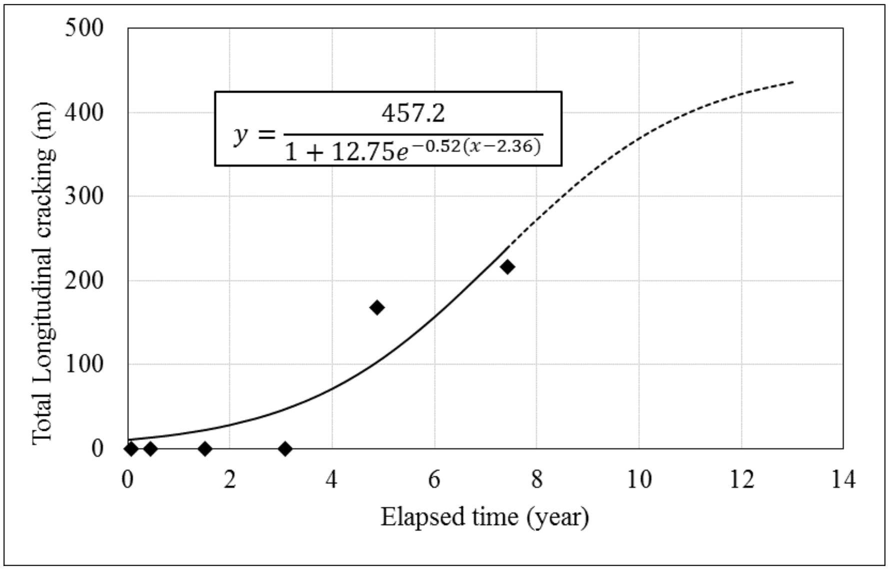


Figure 4.3 Total longitudinal cracking versus time, SPS-3 test section A310, the state of Maryland

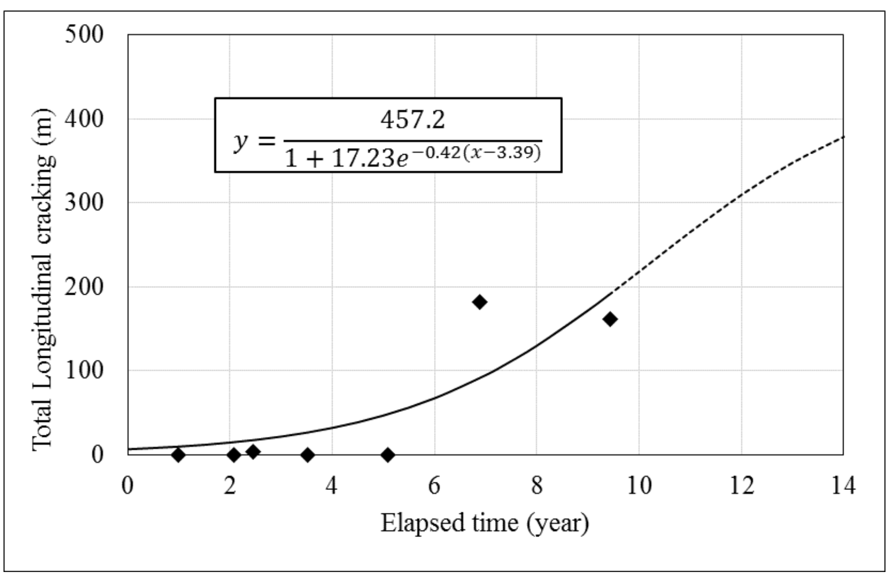


Figure 4.4 Total longitudinal cracking versus time, SPS-3 control section A340, the state of Maryland

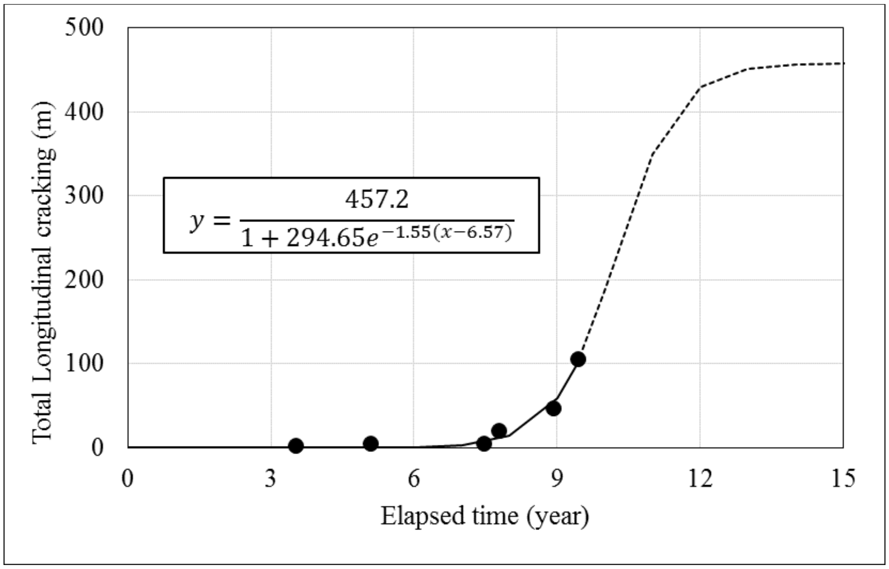


Figure 4.5 Total longitudinal cracking versus elapsed time, LTPP GPS-1634 linked section to SPS-3 experiment in the state of Maryland

Cracking data collected prior to the overlay can also be used as BT data for test section A310. Comparisons of the pavement condition and distress data between the control and the linked section as related to the conditions of the test section were made to verify whether or not the data of the control and/or linked sections are indeed similar to the available BT data points of the test section. Finally, if the data of the control section represents the BT data of the test section, the performance of the two sections were compared to determine the benefits of the treatment applied to the test section.

For some test sections, such as SPS-3 test section A350 in the state of New York, the reported BT longitudinal cracking is about 300 meters, as shown in Figure 4.6. The longitudinal cracking data of the associated control section A340 indicate 60 to 100 meters of cracking, as shown by the open symbols in Figure 4.6. It should be noted that the control section was not subjected to any treatment. Nevertheless, in this and similar cases, the data from the control sections were not used because they were not representative of the BT pavement performance of the test section in question. Please note that, the use of the control section data in place of the BT data significantly increased the number of available test sections for analysis.

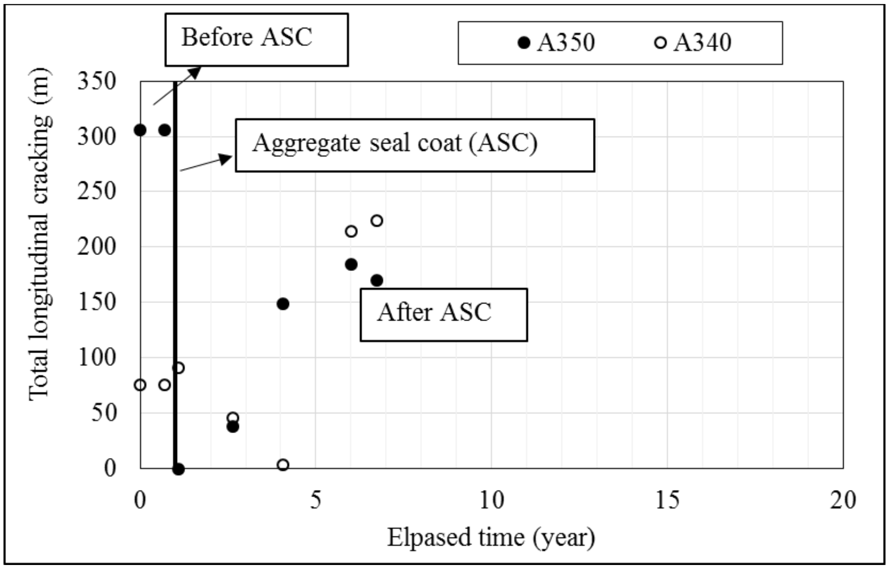


Figure 4.6 Total longitudinal cracking versus elapsed time, SPS-3 test section A350, and A340 control section in the state of New York

Although a treated pavement section may have 3 data points BT and/or AT, it may or may not be accepted for analysis. The BT and/or the AT time series data of some of these test sections indicate that the pavement condition and/or distress is improving over time without the application of any treatment, as shown in Figure 4.7. In the absence of a pavement treatment, most pavement sections deteriorate over time. When the pavement condition and/or distress data indicate improvement over time, without the application of treatment, the data will precipitate negative parameters of the pavement performance model; that is, improved condition and/or distress without treatment. Such pavement condition and distress trends could occur for various reasons including:

- Human error and/or inaccuracy while collecting the data. The subjectivity of assigning distress severity levels and estimating the extent of the distress could generate inaccuracies in the time series data. Properly calibrated sensor measured data do not exhibit this problem as no human subjectivity is involved.

- Data inaccuracy due to the employed equipment, such as calibration, malfunction, or changing equipment type between surveys over time.

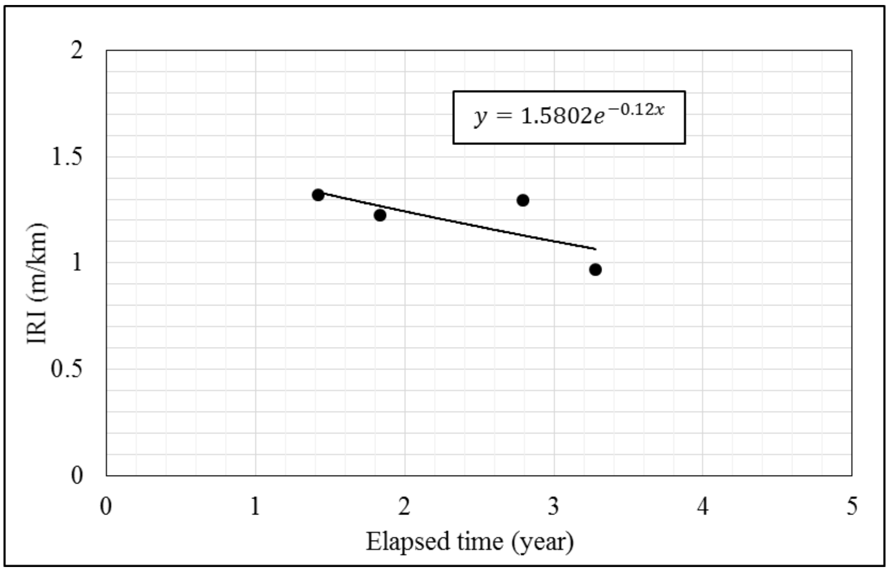


Figure 4.7 IRI versus elapsed time, SPS-1 test section 0119, the state of Texas

- Environmental conditions from one data collection cycle to the next. For example, the crack opening is wider on cold days than on warmer days due to thermal expansion and contraction. This may change the assigned crack severity level and/or the observance of the length of the cracks. Likewise, temperature differential may cause curling on certain days, which influences the measured pavement roughness in terms of IRI.

When the pavement condition and/or distress show improvement over time without any treatment application, the data will yield infinite RFP and/or RSP values and the pavement performance cannot be assessed. For example, the data and the exponential equation in Figure 4.7 indicate improvement of the IRI over time and negative exponential power component. That is, according to the given data and the equation, the IRI will never reach the threshold value and therefore the RFP is infinite, which is not practical. Consequently, any time series condition or distress data showing improvement over time without the application of treatments, is not included in the analyses of the pavement performance.

3. Severity level - Finally, the analyses of cracking data in this study was based on the sum of the data for low, medium, and high severity levels.

CHAPTER 5

DATA ANALYSES – FLEXIBLE PAVEMENTS

5.1 Background

For all LTPP test sections in SPS-1 through SPS-7, GPS-6, GPS-7, and GPS-9, the time series pavement conditions, and distresses data were downloaded and organized in spreadsheet format for analyses. The data from these LTPP test sections and few pavement sections from the three SHAs were modeled using the proper mathematical functions and were subjected to analyses. The procedures and the results of the analyses of the LTPP flexible pavement condition and distress data are presented in this chapter, while the procedure and results for rigid pavement condition and distress data are presented in Chapter 6. Results of the analyses of the three SHAs data are presented and discussed in Chapter 7.

5.2 Modeling of the Time Series Pavement Condition and Distress Data

The time series pavement condition and distress data of all test sections in the SPS-1 through SPS-7 and GPS–6, GPS-7, and GPS-9 experiments were downloaded, organized, and modeled using the proper mathematical functions based on the type of pavement condition or distress. The selected mathematical functions are based on known trends and mechanism of pavement deterioration, as listed in Table 5.1 and shown in Figure 5.1 (Meyer et al. 1999, M-E PDG 2004, Dawson 2012). For example, rutting typically occurs early in the asphalt pavement's life and its accumulation rate decreases over time as the pavement materials densify under traffic loads. Therefore, a power function is typically used to model the time series rut depth data. On the other hand, pavement roughness and typically increase exponentially as the pavement ages, deteriorates, and becomes uneven causing increases in the dynamic effects of traffic loads. Hence, an exponential function is typically used to model the pavement roughness (IRI). Finally, the propagation of pavement cracks typically follows three stages. In the first stage, few cracks appear in the early pavement life; their number and length increase exponentially. In the second stage, the number and length of cracks increase almost linearly over time. In this stage, few new cracks are initiated and most existing cracks approach their maximum possible lengths (lane width or the pavement section length). In the third stage, the number of cracks and their length reach equilibrium as shown by the logistic curve in Figure 5.1. Given the above scenario, the modeling of crack propagation over time could be achieved using two different functions depending on the availability of the data. If the cracking data are available over a short period of time after construction (stage one data only), an exponential function could be used to model the data. On the other hand, if the cracking data are available when the pavement is old (stage three only), a power function could be used. The modeling of the crack propagation using the logistic function cannot be confidently achieved unless at least four data points are available spanning the three crack propagation stages. To alleviate the problem and to increase the number of test sections to be included in the analyses, one crack saturation point was assumed for each type of cracking. The assumed crack saturation points used throughout this study are listed in Table 5.2. The assumption of the crack saturation points is based on engineering logic. For example, the saturation point for alligator cracking is the entire surface area of the pavement section, whereas, the saturation point for longitudinal cracking is three cracks along the entire pavement section.

Note that the square, circle, and triangle symbols in Figure 5.1 represent measured data. The solid portion of the curves are fit to the measured data while the dashed portions are forecasted based on the fit data. After selecting the proper mathematical function, least squares regression technique was used to determine the statistical parameters of the selected mathematical functions. The least squares regression technique is based on minimizing the sum of the squared differences (error) between the calculated and the measured data (Dawson 2012).

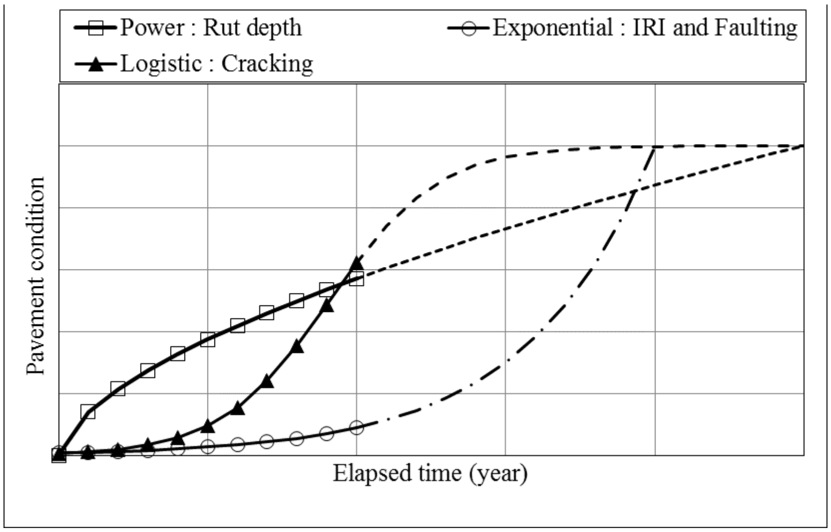


Figure 5.1 Exponential, power, and logistic (s-shaped) curves

To expedite the analyses, a MATLAB based computer program was written to complete the following functions for each pavement condition and distress data set of each LTPP test section and for each pavement treatment type (see the program flowchart in Figure 5.2):

1. Read all available time series data from an Excel spreadsheet.
2. Separate the data to two parts; before and after treatment.
3. Check the available number of time series data points before and after treatment.
4. If three or more data points are available before and/or after the treatment, use the proper mathematical function to fit the data and obtain the statistical parameters of the function.
5. Organize the results (section identification, treatment date and type, climatic regions, traffic, the last collected BT data point, the first collected AT data point, the number of BT and AT data points, and the statistical parameters) in an Excel spreadsheet format

Table 5.1 Mathematical functions used in the analyses of the pavement distress and condition data

<table>
<tr><td rowspan="2">Equation description</td><td colspan="3">The mathematical functions used in modeling pavement condition or distress as functions of time</td></tr>
<tr><td>International Roughness Index (IRI) (inch/mile or m/km)</td><td>Rut depth (RD) (inch or mm)</td><td>Cracking (length, area, or percent)</td></tr>
<tr><td>Function form</td><td>Exponential</td><td>Power</td><td>Logistic (S-shaped)</td></tr>
<tr><td>Generic equation</td><td>$IRI = \alpha e^{\beta t}$</td><td>$RD = \gamma t^{\omega}$</td><td>Crack = $\frac{\theta}{1 + \mu e^{-\varepsilon(t-\rho)}}$</td></tr>
<tr><td>Time when a threshold value is reached</td><td>$t = \left[\frac{\ln\left(\frac{Threshold_{IRI}}{\alpha}\right)}{\beta}\right]$</td><td>$t = exp\left[\frac{\ln\left(\frac{Threshold_{RD}}{\gamma}\right)}{\omega}\right]$</td><td>$t = \frac{-\left[\ln\left(\frac{1}{\mu}\left(\frac{\theta}{Threshold_{crack}} - 1\right)\right) - \varepsilon * \rho\right]}{\varepsilon}$</td></tr>
<tr><td colspan="4">Remaining Functional Period = RFP = $(t - SA) \leq DL - SA$</td></tr>
<tr><td colspan="4">Remaining Structural Period = RSP = $(t - SA) \leq DL - SA$</td></tr>
<tr><td colspan="4">Where, α, β, γ, ω, k, θ, ε, ρ and μ are regression parameters, RD is rut depth, Crack in (crack length, area, or percent), t is the elapsed time in years from after construction or rehabilitation to the time when the threshold value is reached, and Threshold is the pre-specified condition or distress level indicating zero RFP or RSP for a given pavement condition or distress type.
SA = surface age since the last action (year); DL = design life or period or the estimated treatment action life (year)</td></tr>
</table>

Table 5.2 Crack saturation values used in the analyses of the pavement cracking data

Cracking type	Saturation value			Reason
	Per 152.4 m (500 ft) LTPP section	Per 0.1 km	Per 0.1 mile	
Alligator cracking	549 m^2 (5,906 ft^2)	360 m^2	6,336 ft^2	100 percent section cracked (3.66 m (12 ft) lane width)
Longitudinal cracking	457.2 m (1,500 ft)	300 m	1,584 ft	3 cracks along entire section length
Transverse cracking (length), flexible pavements	152.4 m (500 ft)	100 m	528 ft	1 crack every 3.65 m (12 ft)
Number of transverse cracks, flexible pavements	42	28	44	1 crack each 3.65 m (12 ft)
Transverse cracking (length), rigid pavements	114 m (375 ft)	75 m	396 ft	1 crack per slab (4.87 m (16 ft) joint spacing)
Number of transverse cracks, rigid pavements	31	21	33	1 crack per slab (4.87 m (16 ft) joint spacing)
Note: The data in the shaded area are included for convenience. The analyses were conducted using the measured crack lengths and alligator cracked areas.				

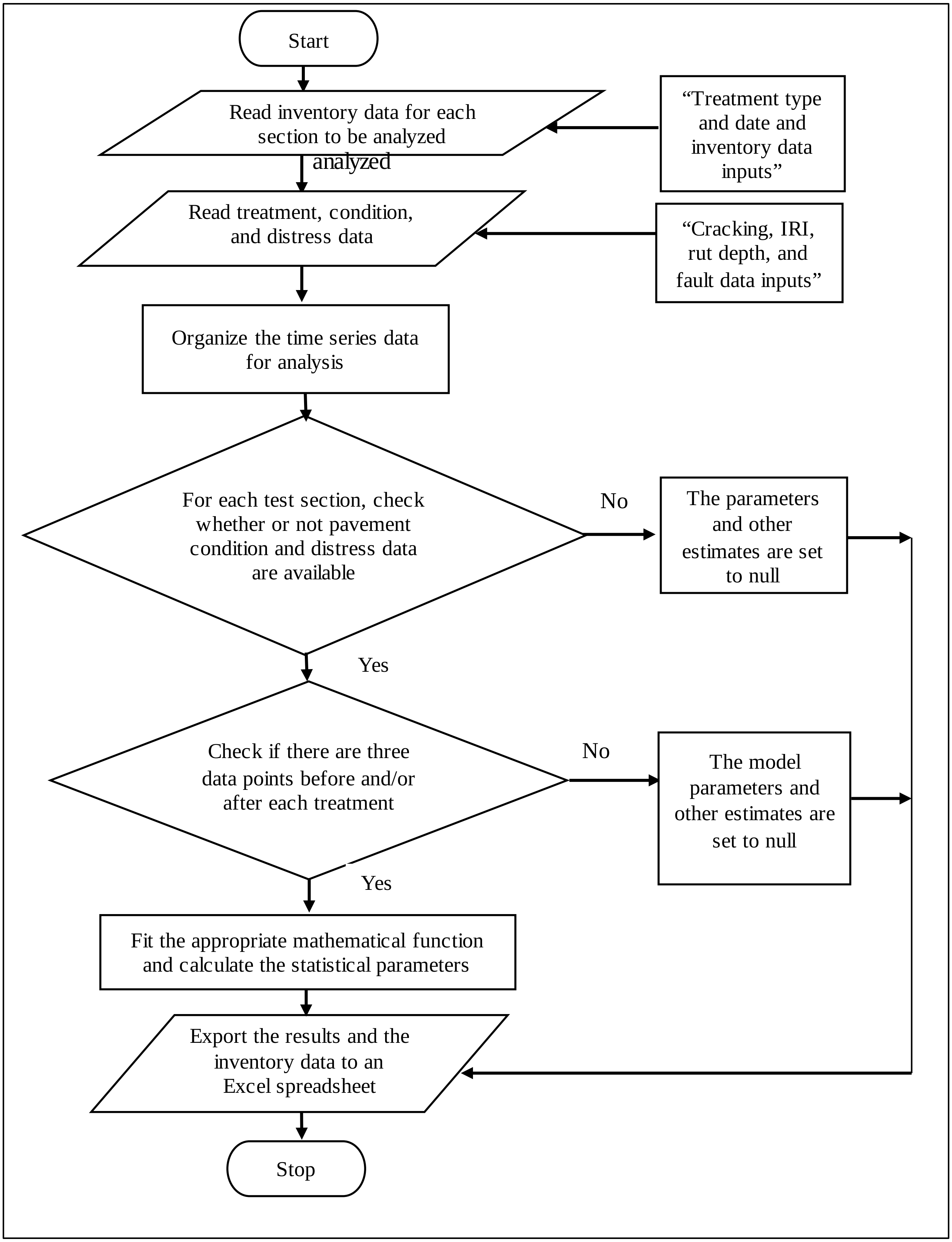


Figure 5.2 Flowchart of the MATLAB program

The MATLAB output data were then subjected to further analyses to estimate, for each test section and for each treatment type, the following parameters:

1. The BT RFP, RSP, and CS.
2. The AT RFP, RSP, and CS.
3. Any changes in the RFP or RSP resulting from the pavement treatment. The change in the RFP or RSP is defined as the differences between the BT RFP or RSP values and the AT RFP or RSP values.
4. The time period for the re-occurrence of the previous pavement conditions (the last collected data point before the application of the preservation treatment).
5. Instantaneous change in the pavement conditions and distresses due to treatment (also called performance jump).

5.3 Impacts of Climatic Regions, Drainage, and AC Thickness on Pavement Performance Using the LTPP SPS-1 Test Sections

Please recall that the main objective of the SPS-1 experiment is to study the effects of the climatic regions and the following structural factors on pavement performance (Von Quintus et al. 2003).

1. Presence or absence of a drainage layer
2. AC thickness (4 in or 7 in)
3. Base type (dense-graded aggregate base, asphalt treated base, permeable asphalt treated base, or a combination thereof)
4. Base thickness (8 in, 12 in, or 16 in)

The analyses of the impacts of the various variables were accomplished in the following steps:

Step 1 - For each pavement test section in the SPS-1 experiment, each of the time dependent pavement condition (IRI) and distress (rut depth, and alligator, transverse, and longitudinal cracking) data were used to calculate the RFP and RSP of that section from the time of construction to the time when the pavement condition or distress reach the appropriate threshold values. The reason for calculating the RFP and RSP from the construction data (surface age is zero) is that the dates of construction and last data collection for different test sections are not the same. This implies that the reference time for all SPS-1 test sections is taken as the date of construction.

Step 2 - For each pavement condition and distress type, the resulting RFP and RSP values and other inventory data (such as SHRP ID, State, AC thickness, drainage, base type and thickness, and so forth) were then organized into an Excel spreadsheet format.

Step 3 – For each SHRP ID and for each pavement condition and distress type, the minimum and maximum RFP and RSP values and their averages were calculated and listed in the Excel spreadsheet.

Step 4 - The data were then divided into the various climatic regions, groups, and subgroups listed below. The main objective of the division is to separate the design variables impacting pavement performance.

1 - Climatic Regions – The results were divided into four climatic regions; wet-freeze (WF), wet-no-freeze (WNF), dry-freeze (DF), and dry-no-freeze (DNF).

2 - AC Thickness Groups – The results in each climatic region were then divided into two groups based on the thickness of the AC (4 and 7 in).

3 - Drainage Subgroup – The results in each AC thickness group were then divided into two drainage subgroups (presence and absence of drainage).

It should be noted that various attempts were made to divide the results in each drainage subgroup into base thickness and base type subgroups and into three traffic levels. Unfortunately, none of the attempts was successful because any further division yielded insignificant number of test sections in each subgroup such that no decisions could be made with any level of certainty. Therefore, the impacts of the base thickness and type were not studied any further.

The impacts of the four climatic regions (WF, WNF, DF, and DNF), the AC thickness (4 and 7 in), and drainable and undrainable bases on the pavement performance in terms of the RFP and RSP were analyzed. The detailed results of the analyses were tabulated and are included in Tables C.1 through C.20 and Figures C.1 through C.20 of Appendix C. For convenience, the detailed results were summarized and are listed in Tables 5.3 through 5.8.

The materials below provide explanation and discussion of the numbers (analyses results) in each cell of Tables 5.3 through 5.8. The presentation, discussion, and conclusions are organized in subsections based on the type of pavement condition and distress.

The data in Tables 5.3 through 5.8 address the impact of climatic regions, the AC thickness, and drainable and undrainable bases on the pavement performance (in terms of the RFP and RSP values) of the SPS-1 test sections. The numbers in the tables indicate the differences in years in the RFP or RSP values of the SPS-1 test sections having the top heading parameters relative to the RFP and RSP values of the SPS-1 test sections having the side heading parameters. Thus, in each of Tables 5.3 through 5.7, the shaded diagonal represents the line of symmetry. If the table is folded along the diagonal, the aligned numbers from above and from below the diagonal will be the same but with different sign. Nevertheless, the proper readings of the data in the tables is illustrated in two examples below.

Example 1: this example illustrates how to read the data in Tables 5.3 through 5.7, with example data from Table 5.3. The first four numbers in the first row below the top headings imply the following:

1. The average RFP of the test sections located in the WF region and having 4-inch thick AC layer and undrainable bases is 5 years shorter (-5) than compatible test sections with drainable bases.
2. The average RFP of the test sections located in the WF region and having 7-inch thick AC layer and drainable bases is the same (0) as those having 4-inch thick AC layer with drainable bases.
3. The average RFP of test sections located in the WF region and having 7-inch thick AC layer and undrainable bases is 2 years shorter (-2) than those having 4-inch thick AC layer with drainable bases.
4. The average RFP of the test sections located in the WNF region and having 4-inch thick AC layer and drainable bases is 2 years longer (2) than those located in the WF region and having 4-inch thick AC layer and drainable bases.

Example 2; this example illustrates how to read the data in Tables 5.8. The data in the table address the impact of the climatic regions on the pavement condition (IRI) and distresses (rut depth and alligator, longitudinal, and transverse cracking). The numbers in the table indicate the percent of the test sections having the heading parameters performed either better, the same, or worse relative to the test sections having the side heading parameters. For example, for IRI, the six numbers (three numbers in each of the top two populated rows in the three columns under the heading WF) and for rut depth, the six numbers (three numbers in each of the next two populated rows) under the same three columns heading (WF) imply the following:

Table 5.3 Summary of the results of analyses of the impacts of design factors on RFP of LTPP SPS-1 test sections based on IRI

			WF				WNF				DF				DNF			
			4” AC		7” AC		4” AC		7” AC		4” AC		7” AC		4” AC		7” AC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	4” AC	D		-5	0	-2	2	2	2	2	0	2	2	2	2	1	2	2
		ND	5		4	3	7	7	7	7	5	7	7	7	7	6	7	7
	7” AC	D	0	-4		-1	2	2	2	2	1	2	2	2	2	1	2	2
		ND	2	-3	1		4	3	4	4	2	4	4	4	4	3	4	4
WNF	4” AC	D	-2	-7	-2	-4		0	0	0	-2	0	0	0	0	-1	0	0
		ND	-2	-7	-2	-3	0		0	0	-1	0	0	0	0	-1	0	0
	7” AC	D	-2	-7	-2	-4	0	0		0	-2	0	0	0	0	-1	0	0
		ND	-2	-7	-2	-4	0	0	0		-2	0	0	0	0	-1	0	0
DF	4” AC	D	0	-5	-1	-2	2	1	2	2		2	2	2	2	1	2	2
		ND	-2	-7	-2	-4	0	0	0	0	-2		0	0	0	-1	0	0
	7” AC	D	-2	-7	-2	-4	0	0	0	0	-2	0		0	0	-1	0	0
		ND	-2	-7	-2	-4	0	0	0	0	-2	0	0		0	-1	0	0
DNF	4” AC	D	-2	-7	-2	-4	0	0	0	0	-2	0	0	0		-1	0	0
		ND	-1	-6	-1	-3	1	1	1	1	-1	1	1	1	1		1	1
	7” AC	D	-2	-7	-2	-4	0	0	0	0	-2	0	0	0	0	-1		0
		ND	-2	-7	-2	-4	0	0	0	0	-2	0	0	0	0	-1	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = un-drainable base; AC = asphalt concrete

Table 5.4 Summary of the results of analyses of the impacts of design factors on RFP/RSP of LTPP SPS-1 test sections based on RD

			WF				WNF				DF				DNF			
			4” AC		7” AC		4” AC		7” AC		4” AC		7” AC		4” AC		7” AC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	4” AC	D		-5	-1	-3	5	5	5	5	4	6	6	6	6	6	6	6
		ND	5		4	2	10	10	10	10	9	11	11	11	11	11	11	11
	7” AC	D	1	-4		-3	6	6	5	6	5	7	7	7	7	7	7	7
		ND	3	-2	3		8	9	8	9	7	9	9	9	9	9	9	9
WNF	4” AC	D	-5	-10	-6	-8		0	0	1	-1	1	1	1	1	1	1	1
		ND	-5	-10	-6	-9	0		0	0	-1	1	1	1	1	1	1	1
	7” AC	D	-5	-10	-5	-8	0	0		1	-1	1	1	1	1	1	1	1
		ND	-5	-10	-6	-9	-1	0	-1		-2	1	1	1	1	1	1	1
DF	4” AC	D	-4	-9	-5	-7	1	1	1	2		2	2	2	2	2	2	2
		ND	-6	-11	-7	-9	-1	-1	-1	-1	-2		0	0	0	0	0	0
	7” AC	D	-6	-11	-7	-9	-1	-1	-1	-1	-2	0		0	0	0	0	0
		ND	-6	-11	-7	-9	-1	-1	-1	-1	-2	0	0		0	0	0	0
DNF	4” AC	D	-6	-11	-7	-9	-1	-1	-1	-1	-2	0	0	0		0	0	0
		ND	-6	-11	-7	-9	-1	-1	-1	-1	-2	0	0	0	0		0	0
	7” AC	D	-6	-11	-7	-9	-1	-1	-1	-1	-2	0	0	0	0	0		0
		ND	-6	-11	-7	-9	-1	-1	-1	-1	-2	0	0	0	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = un-drainable base; AC = asphalt concrete

Table 5.5 Summary of the results of analyses of the impacts of design factors on RSP of LTPP SPS-1 test sections based on ALC

			WF				WNF				DF				DNF			
			4” AC		7” AC		4” AC		7” AC		4” AC		7” AC		4” AC		7” AC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	4” AC	D		-4	-3	-3	0	0	2	2	-3	-5	-2	-3	-5	-6	-1	-2
		ND	4		1	1	4	3	5	5	0	-2	2	1	-1	-2	3	2
	7” AC	D	3	-1		0	3	2	4	4	-1	-3	1	0	-2	-3	2	1
		ND	3	-1	0		3	3	5	5	0	-2	1	0	-1	-3	2	2
WNF	4” AC	D	0	-4	-3	-3		-1	1	1	-4	-6	-2	-3	-5	-6	-1	-2
		ND	0	-3	-2	-3	1		2	2	-3	-5	-2	-3	-4	-6	-1	-1
	7” AC	D	-2	-5	-4	-5	-1	-2		0	-5	-7	-4	-5	-6	-8	-3	-3
		ND	-2	-5	-4	-5	-1	-2	0		-5	-7	-4	-4	-6	-8	-3	-3
DF	4” AC	D	3	0	1	0	4	3	5	5		-2	1	1	-1	-3	2	2
		ND	5	2	3	2	6	5	7	7	2		3	2	1	-1	4	4
	7” AC	D	2	-2	-1	-1	2	2	4	4	-1	-3		-1	-2	-4	1	0
		ND	3	-1	0	0	3	3	5	4	-1	-2	1		-2	-3	2	1
DNF	4” AC	D	5	1	2	1	5	4	6	6	1	-1	2	2		-1	3	3
		ND	6	2	3	3	6	6	8	8	3	1	4	3	1		5	4
	7” AC	D	1	-3	-2	-2	1	1	3	3	-2	-4	-1	-2	-3	-5		0
		ND	2	-2	-1	-2	2	1	3	3	-2	-4	0	-1	-3	-4	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = un-drainable base; AC = asphalt concrete

Table 5.6 Summary of the results of analyses of the impacts of design factors on RSP of LTPP SPS-1 test sections based on LC

			WF				WNF				DF				DNF			
			4” AC		7” AC		4” AC		7” AC		4” AC		7” AC		4” AC		7” AC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	4” AC	D		-1	-1	0	5	6	6	5	1	0	-1	0	6	5	6	7
		ND	1		0	1	6	7	7	6	1	1	0	1	7	6	6	8
	7” AC	D	1	0		1	6	7	7	6	2	1	0	1	7	6	7	8
		ND	0	-1	-1		5	6	6	5	0	0	-1	0	6	5	5	7
WNF	4” AC	D	-5	-6	-6	-5		1	1	0	-5	-5	-6	-5	1	0	0	2
		ND	-6	-7	-7	-6	-1		0	-2	-6	-6	-7	-6	-1	-1	-1	1
	7” AC	D	-6	-7	-7	-6	-1	0		-1	-6	-6	-7	-6	0	-1	-1	1
		ND	-5	-6	-6	-5	0	2	1		-4	-5	-5	-5	1	0	1	2
DF	4” AC	D	-1	-1	-2	0	5	6	6	4		0	-1	-1	5	4	5	7
		ND	0	-1	-1	0	5	6	6	5	0		-1	0	6	5	5	7
	7” AC	D	1	0	0	1	6	7	7	5	1	1		1	7	6	6	8
		ND	0	-1	-1	0	5	6	6	5	1	0	-1		6	5	6	7
DNF	4” AC	D	-6	-7	-7	-6	-1	1	0	-1	-5	-6	-7	-6		-1	0	1
		ND	-5	-6	-6	-5	0	1	1	0	-4	-5	-6	-5	1		1	2
	7” AC	D	-6	-6	-7	-5	0	1	1	-1	-5	-5	-6	-6	0	-1		2
		ND	-7	-8	-8	-7	-2	-1	-1	-2	-7	-7	-8	-7	-1	-2	-2	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = un-drainable base; AC = asphalt concrete

Table 5.7 Summary of the results of analyses of the impacts of design factors on RSP of LTPP SPS-1 test sections based on TC

			WF				WNF				DF				DNF			
			4” AC		7” AC		4” AC		7” AC		4” AC		7” AC		4” AC		7” AC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	4” AC	D		1	2	1	3	3	4	3	-3	2	-3	0	-1	2	2	0
		ND	-1		2	1	2	2	3	2	-4	1	-4	0	-1	1	1	0
	7” AC	D	-2	-2		-1	1	0	1	1	-6	0	-5	-2	-3	-1	0	-2
		ND	-1	-1	1		2	1	2	2	-5	1	-4	-1	-2	0	1	-1
WNF	4” AC	D	-3	-2	-1	-2		-1	0	0	-7	-1	-6	-3	-4	-1	-1	-3
		ND	-3	-2	0	-1	1		1	1	-6	0	-5	-2	-3	-1	0	-2
	7” AC	D	-4	-3	-1	-2	0	-1		0	-7	-1	-6	-3	-4	-2	-1	-3
		ND	-3	-2	-1	-2	0	-1	0		-7	-1	-6	-3	-4	-1	-1	-3
DF	4” AC	D	3	4	6	5	7	6	7	7		6	1	4	3	5	6	4
		ND	-2	-1	0	-1	1	0	1	1	-6		-5	-2	-3	0	0	-2
	7” AC	D	3	4	5	4	6	5	6	6	-1	5		3	2	5	5	3
		ND	0	0	2	1	3	2	3	3	-4	2	-3		-1	1	2	0
DNF	4” AC	D	1	1	3	2	4	3	4	4	-3	3	-2	1		2	3	1
		ND	-2	-1	1	0	1	1	2	1	-5	0	-5	-1	-2		0	-1
	7” AC	D	-2	-1	0	-1	1	0	1	1	-6	0	-5	-2	-3	0		-2
		ND	0	0	2	1	3	2	3	3	-4	2	-3	0	-1	1	2	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = un-drainable base; AC = asphalt concrete

Table 5.8 Summary of the results of analyses of the effects of climatic regions on the performance of the LTPP SPS-1 test sections

Condition or distress type	Climatic region	Climatic regions and the percent of test sections where RFP/RSP was better, equal, or worse than other climatic regions											
		WF			WNF			DF			DNF		
		Better	Same	Worse	Better	Same	Worse	Better	Same	Worse	Better	Same	Worse
IRI	WF				58	4	38	56	28	17	58	42	0
	WNF	38	4	58				77	6	17	8	84	8
	DF	17	28	56	17	6	77				17	72	11
	DNF	0	42	58	8	84	8	11	72	17			
RD	WF				83	17	0	82	13	5	73	27	0
	WNF	0	17	83				23	68	9	9	91	0
	DF	5	13	82	9	68	23				0	100	0
	DNF	0	27	73	0	91	9	0	100	0			
AC	WF				67	8	25	42	4	54	42	8	50
	WNF	25	8	67				38	8	54	13	0	87
	DF	54	4	42	54	8	38				46	17	38
	DNF	50	8	42	87	0	13	38	17	46			
LC	WF				88	8	4	46	4	50	92	8	0
	WNF	4	8	88				8	29	63	42	42	16
	DF	50	4	46	63	29	8				67	29	4
	DNF	0	8	92	16	42	42	4	29	67			
TC	WF				54	33	13	42	12	46	46	21	33
	WNF	13	33	54				38	54	8	7	50	42
	DF	46	12	42	8	54	38				42	46	12
	DNF	33	21	46	42	50	7	12	46	42			

IRI = International Roughness Index; RD = rut depth; AC = alligator cracking; LC = longitudinal cracking; and TC = transverse cracking

1. Relative to IRI, 38 percent of the test sections located in the WF region performed better than those located in the WNF region, four percent performed the same, and 58 percent performed worse.
2. Relative to IRI, 17 percent of the test sections located in the WF region performed better than compatible sections located in the DF region, 28 percent performed the same, and 56 percent performed worse.
3. Relative to rut depth, none of the test sections located in the WF region performed better than those located in the WNF region, 17 percent performed the same, and 83 percent performed worse.
4. Relative to rut depth, five percent of the test sections located in the WF region performed better than compatible sections located in the DF region, 13 percent performed the same, and 82 percent performed worse.

To this end, the discussion of the analyses results listed in Tables 5.3 through 5.7 are organized relative to the pavement condition and distress type and presented below.

5.3.1 International Roughness Index (IRI)

The calculated minimum, maximum, and average RFP values for the SPS-1 test sections having the same SHRP ID and located in each climatic region are listed in Tables C.1 through C.4 and shown in Figures C.1 through C.4 of Appendix C. As stated earlier, for convenience, the analyses results listed in Tables C.1 through C.4 are summarized in Table 5.3. The data in the summary table indicate that the differences between the average RFP of test sections located in different climatic regions and having 4 or 7-inch thick AC layers with drainable and undrainable bases vary from negative one to seven years. Since the one-year difference is not significant and is within the data variability, it will be considered as zero value in the discussion below. Nevertheless, the data in Table 5.3 indicate that:

1. In the WF region, the average RFP of test sections having 4-inch AC thickness and undrainable bases is about five years less than the average RFP of compatible test sections with drainable bases. The five-year difference decreases to two years when the AC thickness of the undrainable test sections increases from 4 to 7-inch. That is the average RFP of test sections having 7-inch thick AC layer and undrainable bases is about three years higher than test sections having 4-inch thick AC layer and undrainable bases. Finally, for test sections having 7-inch thick AC layer and drainable bases, the average RFP is the same as test sections having 4-inch thick AC and drainable bases and four years higher relative to test sections having 4-inch thick AC layer and undrainable bases.
2. Also in the WF regions, the average RFP of the test sections having 4-inch and 7-inch thick AC layers and drainable and undrainable bases is two to seven years lower than compatible test sections located in the other three climatic regions.
3. In the WNF, DF, and DNF climatic regions the RFP of the test sections having 4-inch and 7-inch thick AC layers and drainable and undrainable bases is two to seven years higher than compatible test sections located in the WF region.
4. In the WNF region, the RFP/RSP of the test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases is almost the same.
5. In the DF region, the average RFP of the test sections having 4-inch thick AC layer and drainable bases is about two years shorter than test sections having 4 and 7--inch thick AC layers and drainable and undrainable bases located in the WNF and DNF climatic regions.
6. In the DNF region, test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases performed almost the same. That is the existence of drainable bases and thicker AC layer did not affect the pavement performance relative to IRI.

The impact of climatic regions on pavement performance relative to IRI is summarized in Table 5.8. The data in the table indicate that:

1. Fifty-eight percent of the test sections located in the WF regions performed worse, four percent performed the same, and thirty-eight percent performed better than compatible test sections located in the WNF regions.
2. Fifty-six percent of the test sections located in the WF regions performed worse, twenty-eight percent performed the same, and seventeen percent performed better than compatible test sections located in the DF regions.
3. Seventy-seven percent of the test sections located in the DF region performed better than compatible sections located in the WNF region. While test sections located in the DNF and WNF performed almost the same.

5.3.2 Rut Depth (RD)

The calculated minimum, maximum, and average RSP values based on rut depths for the SPS-1 test sections having the same SHRP ID and located in each climatic region are listed in Tables C.5 through C.8 and shown in Figures C.5 through C.8 of Appendix C. The results are also summarized in Table 5.4. Examination of the data listed in Table 5.4 indicates that on average:

1. In the WF regions, the average RFP/RSP of the SPS-1 test sections having 4-inch thick AC and undrainable bases is five years lower than the average RSP of compatible test sections with drainable bases. Further, the average RFP/RSP of SPS-1 test sections having 7-inch thick AC layer and undrainable bases is three years lower than compatible sections with drainable bases.
2. All SPS-1 test sections having 4-inch or 7-inch thick AC layer and drainable or undrainable bases located in the WNF, DF, and DNF climatic regions performed significantly better than

compatible test sections located in the WF regions. The differences in the RFP/RSP vary from five to 11 years.

The impact of climatic regions on pavement performance relative to rut depth is summarized in Table 5.8. The data in the table indicate that:

1. Eighty-three percent, eighty-two percent, and seventy-three percent of the SPS-1 test sections located in the WF regions performed worse than compatible test sections located, respectively, in the WNF, DF, and DNF regions.
2. Almost all SPS-1 test sections located in the DNF region performed the same as compatible test sections located in the WNF and DF climatic regions.

5.3.3 Alligator cracking (AlC)

For all SPS-1 test sections having the same SHRP ID, the same AC thickness, the same drainage type, and located in the same climatic region, the calculated minimum, maximum, and average RSP values based on alligator cracking are listed in Tables C.9 through C.12 and shown in Figures C.9 through C.12 of Appendix C. The average RSP of all SPS-1 test sections having different SHRP ID but the same AC thickness, drainage type and located in the same climatic region was calculated and summarized in Table 5.5. Examination of the data listed in Table 5.5 indicates that on average:

1. In the WF regions, the average RSP of test sections having 4-inch thick AC layer and undrainable bases is four years lower than the average RSP of test sections having 4-inch thick AC layer and drainable bases. Further, the RSP of SPS-1 test sections having 7-inch thick AC layer and drainable and undrainable bases is almost the same.

2. SPS-1 test sections having 4 and 7-inch thick AC layers and drainable or undrainable bases located in the WNF region have higher RSP values relative to compatible test sections located in the WF region.
3. All SPS-1 test sections located in the DNF regions have lower RSP than those located in the WNF region. The differences in the RSP vary from one to eight years.

The impact of climatic regions on pavement performance relative to alligator cracking is summarized in Table 5.8. The data in the table indicate that:

1. Sixty-seven percent of the SPS-1 test sections located in the WF regions showed worse, eight percent showed the same, and twenty-five percent showed better performance than compatible test sections located in the WNF region.
2. Fifty-four percent and fifty percent of the SPS-1 test sections located in the WF regions performed better and forty-two percent performed worse than compatible test sections located, respectively, in the DF and DNF regions. Hence, statistically speaking, SPS-1 test sections located in the WF region have slightly better performance than those in the DF and DNF regions.
3. Forty-six percent of the SPS-1 test sections located in the DNF regions performed better than compatible test sections located in the DF region, whereas thirty-eight percent performed worse.
4. Finally, eighty-seven percent of the SPS-1 test sections located in the DNF region performed worse than compatible test sections located in the WNF region and only thirteen percent performed better.

5.3.4 Longitudinal Cracking (LC)

For all SPS-1 test sections having the same SHRP ID, the same AC thickness, the same drainage type, and located in the same climatic region, the calculated minimum, maximum, and average RSP values based on longitudinal cracking are listed in Tables C.13 through C.16 and shown in Figures C.13 through C.16 of Appendix C. The results are also summarized in Table 5.6. Examination of the data listed in the table indicate that on average:

1. All SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases and located in WF climatic region showed almost the same RSP relative to longitudinal cracking.
2. The RSP values of most SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases located in the WNF, DF, and DNF regions are higher than compatible test sections located in the WF region. The differences in the RSP vary from one to eight years.
3. The RSP values of almost all SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases located in the DF and DNF regions are lower than the RSP of compatible test sections located in the WNF region. The differences in the RSP values vary from one to seven years.
4. Finally, the RSP of all SPS-1 test sections located in the DNF region is higher than the RSP of compatible sections located in the DF region. The differences in the RSP values vary from one to seven years.

The impact of climatic regions on pavement performance relative to longitudinal cracking is summarized in Table 5.8. The data in the table indicate that:

1. Eighty-eight percent and ninety-two percent of the SPS-1 test sections located in the WF regions performed worse than compatible test sections located, respectively, in the WNF and DNF regions.
2. Statistically speaking, the performance of SPS-1 test sections located in the WF region is almost the same as those located in the DF region. The data indicate that fifty percent performed better and forty-six percent performed worse.
3. Forty-two percent of the SPS-1 test sections located in the DNF regions performed better than compatible test sections located in the WNF region, and forty-two percent performed the same and only sixteen percent performed worse.
4. Sixty-seven percent of the SPS-1 test sections located in the DNF regions performed better than compatible test sections located in the DF regions while twenty-nine percent performed the same.

5.3.5 Transverse Cracking (TC)

For all SPS-1 test sections having the same SHRP ID, the same AC thickness, the same drainage type, and located in the same climatic region, the calculated minimum, maximum, and average RSP values based on longitudinal cracking are listed in Tables C.17 through C.20 and shown in Figures C.17 through C.20 of Appendix C. The results are also summarized in Tables 5.7. The data in the table indicate that:

1. In the WF region, the average RSP values of test sections having 4-inch and 7-inch thick AC layers and undrainable bases are almost the same as compatible sections with drainable bases. Further, the average RSP for SPS-1 test sections having 7-inch thick AC layer and drainable bases is two years higher than test sections having 4-inch thick AC layer and drainable bases.

2. All SPS-1 test sections located in the WNF regions have one to four year higher RSP values than compatible sections located in the WF region.
3. The majority of the SPS-1 test sections located in the DF and DNF regions have lower RSP than compatible sections located in the WF and WNF regions.

The majority of the SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases and located in the DNF region have higher RSP values than compatible test sections located in the DF region.

The impact of climatic regions on pavement performance relative to transverse cracking is summarized in Table 5.8. The data in the table indicate that:

1. Fifty-four percent of the SPS-1 test sections located in the WF regions performed worse, thirteen percent performed better, and thirty-three percent performed the same as compatible test sections located in the WNF region.
2. Statistically speaking, the performance of SPS-1 test sections located in the WF and DF and DNF regions is the same.
3. Forty-two percent of the SPS-1 test sections located in the WNF regions performed better, fifty percent performed the same, and seven percent performed worse than compatible test sections located in the DNF region.
4. Forty-two percent of the SPS-test sections located in the DNF regions performed better, forty-six percent performed the same, and twelve percent performed worse than compatible test sections located in the DF region.

5.4 Summary, Conclusions, and Recommendations, SPS-1

The performance of each of the SPS-1 test sections was analyzed using the available time series IRI, rut depth, and alligator, longitudinal, and transverse cracking data and the proper mathematical functions. The results of the analyses were then expressed in terms of the RFP for IRI, the RFP/RSP for rut depth, and the RSP for each cracking type. The test sections and their performance (RFP and RSP) were then tabulated using the SHRP IDs, climatic regions, AC thicknesses, and drainable or undrainable bases. Based on the results, the following conclusions were drawn.

1. WF regions have a significant impact on pavement performance in terms of IRI, rut depth, and cracking. This conclusion was expected, due to the repeated volume changes caused by freezing and thawing groundwater, and has been reported by many researchers. Results of the analyses suggest that base drainage and AC thickness should be carefully examined in the pavement design in the WF region.
2. Drainable bases decrease the impact of the WF regions on pavement performance. Once again, this conclusion was expected and it was reported in the AASHTO 1983 Pavement Design Guide.
3. Increasing the thickness of the AC layer from 4 to 7-inch increases the frost protection of the lower layers and hence, it decreases the impact of the WF region. However, this option is not a cost-effective one.
4. The improvement of the pavement performance in the WF regions is almost equally affected by increasing the AC thickness or by including drainable bases. The latter option however, is a more cost-effective option.
5. The other three climatic regions (WNF, DF, and DNF) do not impact the pavement performance relative to rutting potential.
6. The DF region has more adverse effects on cracking potential than the DNF region. This could be attributed to higher oxidation (aging) potential of the AC layer in the DF region.

7. The DNF regions have significantly higher adverse effects on cracking potential than the WNF region. This could be attributed to higher solar radiation in the DNF region, which oxidizes the asphalt binder and makes AC more susceptible to cracking.
8. The inclusion of drainable bases in the DF and DNF regions does not impact pavement performance in terms of RFP or RSP. This was expected because the volume and frequency of available water are low. Further most rainfalls take place over short period of time where most water runs off the surface and does not penetrate the pavement layers.
9. The pavement performance relative to IRI and rut depths of most LTPP SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases and located in the WNF and DNF regions is very much similar. This scenario is substantially different based on cracking potential as stated in the above stated conclusions. Similarly, the pavement performance relative to IRI and rut depths of most LTPP SPS-1 test sections having 4 and 7-inch thick AC layers and drainable and undrainable bases and located in the DNF and DF regions is similar. Once again, this scenario is substantially different based on cracking potential.

5.5 Impacts of Maintenance Treatments on Pavement Performance Using the LTPP SPS-3 Test Sections

The main objective of SPS-3 experiment is to compare the performance of different maintenance treatments on flexible pavements relative to the control (untreated) test sections. The 81 SPS-3 test sites were initiated between 1990 and 1991 and are distributed across the USA and Canada. Each of the SPS-3 test sites consists of four test sections for a total of 324 test sections. Fifty-one of the 81 test sites have control test sections labeled 340. The other thirty sites are linked to a GPS test section, listed in Table 5.9 along with their SHRP ID that can be used as control sections (Hall et al. 2002). Each of the four SPS-3 test sections in each test site was subjected to one of the treatment listed below.

1. Thin overlay (310)
2. Slurry seal (320)
3. Crack seal (330)
4. Aggregate seal coat; chip seal (350)

There are several variables that affect the performance of the treated pavement sections. These include climatic region, traffic, subgrade type, and the before treatment pavement condition and distress. Unfortunately, these variables cannot be separated to analyze the effects of each on pavement performance. The reason is that separating the variables yields statistically insignificant number of test sections to be used in the analyses. To illustrate, Table 5.10 provides a list of the number of test sections available for analyses based on the separation of the following variables:

- Four treatment types
- One pavement condition (IRI)
- Four pavement distress types
- Four climatic regions; WF, WNF, DF, and DNF
- Three traffic levels

It can be seen from the table that in some cells, especially in the DF and DNF regions and for some pavement distress types, the number of available test sections for analyses is not significant (ranges from zero to two). Therefore, the analyses were conducted to assess the impact of each treatment type in each climatic region and for each pavement condition and distress type. That is, the data were not separated based on traffic level, type of base and subbase, or type of roadbed soil. Nevertheless, the analyses of the impacts of each of the four treatment types on pavement performance were accomplished using the following steps:

Step 1 – For each treated pavement test section in the SPS-3 experiment, the available pavement condition (IRI) and distress data in the LTPP database were used to calculate the RFP and RSP of that section after treatment.

Step 2 – For each SPS-3 test section, each pavement condition and distress type, and for each pavement treatment type, the minimum and maximum RFP and RSP values were calculated and are listed in various tables included below. Further, the averages of the RFP and RSP of all test sections located in the same climatic region were also calculated and are listed in the same tables.

Step 3 – The time dependent pavement condition and distress data of each control section and/or linked GPS section in the SPS-3 experiment were used to calculate the RFP and RSP of that section after the assignment date.

Table 5.9 Linked GPS sections that serve as control sections (after Hall et al. 2002)

Site ID	Linked GPS section ID	Site ID	Linked GPS section ID
04_A300	4_1036	40_B300	40_1015
04_B300	4_1021	40_C300	40_4088
04_D300	4_1016	47_A300	47_3101
05_A300	5_3071	47_B300	47_3075
08_B300	8_2008	47_C300	47_1023
12_A300	12_9054	48_D300	48_2172
12_B300	12_3997	48_G300	48_1169
12_C300	12_4154	49_A300	49_1004
16_A300	16_1020	49_B300	49_1017
16_B300	16_1021	49_C300	49_1006
16_C300	16_1010	53_A300	53_1008
28_A300	28_1802	53_B300	53_1501
30_A300	30_1001	53_C300	53_1801
32_A300	32_1021	56_A300	56_1007
32_C300	32_2027	56_B300	56_7775

Table 5.10 Number of test sections that have BT and AT pavement condition, distress, and traffic data

Condition or distress type	Treatment type	Traffic level experience by the test sections in the various climatic regions											
		Wet-freeze			Wet-no-freeze			Dry-freeze			Dry-no-freeze		
		L	M	H	L	M	H	L	M	H	L	M	H
IRI	Thin overlay	8	4	4	8	2	6	3	4	3	1	0	1
	Slurry seal	6	4	4	6	3	6	3	3	2	1	0	1
	Crack seal	7	4	4	2	1	6	3	3	2	1	0	1
	Aggregate seal coat	5	4	4	7	2	5	3	3	3	0	1	1
Rut depth	Thin overlay	4	2	2	4	2	7	2	1	2	0	0	1
	Slurry seal	4	1	2	4	2	8	2	2	2	1	0	1
	Crack seal	4	1	3	2	0	6	3	2	2	0	0	1
	Aggregate seal coat	1	2	1	5	1	9	2	2	1	0	0	1
Alligator cracking	Thin overlay	4	2	4	4	2	5	1	0	0	0	0	0
	Slurry seal	1	0	3	5	0	5	0	0	0	0	0	0
	Crack seal	1	0	1	3	2	2	0	0	0	0	0	0
	Aggregate seal coat	2	0	3	4	0	3	0	0	0	0	0	0
Longitudinal cracking	Thin overlay	4	2	4	4	2	5	1	0	0	0	0	0
	Slurry seal	2	0	3	5	0	5	0	0	0	0	0	0
	Crack seal	1	0	3	2	3	3	0	0	0	0	0	0
	Aggregate seal coat	3	0	3	4	0	4	0	0	0	0	0	0
Transverse cracking	Thin overlay	4	2	4	4	2	5	1	0	0	0	0	0
	Slurry seal	1	0	3	5	0	4	0	0	0	0	0	0
	Crack seal	2	0	3	3	2	3	0	0	0	0	0	0
	Aggregate seal coat	2	0	3	4	0	3	0	0	0	0	0	0

L = low traffic (0 to 60,000 yearly ESAL); M = medium traffic (61,000 to 120,000 yearly ESAL); H = high traffic (>120,000 yearly ESAL)

For each pavement condition and distress type, the test section was analyzed if the database contains at least one data point before treatment and/or three or more data points after treatment that can be modeled.

5.5.1 International Roughness Index (IRI)

The calculated minimum, maximum, and average RFP values based on IRI data for the LTPP SPS-3 test sections that were subjected to the same treatment type and located in the same climatic region, and for the associated control sections are listed in Table 5.11. To assist the reader in the interpretation of the data in the table, the numbers listed in the first row of the table indicate that:

- There are 19 SPS-3 test sections in the WF region that were subjected to thin overlay and accepted for analyses. The minimum, maximum, and average RFP of the 19 SPS-3 test sections are 4, 20, and 16 years, respectively.
- There are 21 control sections in the WF region with a minimum RFP of 0 years, a maximum RFP of 19 years, and an average RFP of 11 years.
- The difference in the averages RFP of the test sections and the average RFP of the control sections is 5 years. That is, on average, the RFP of the treated sections is 5 years higher than the control sections.

Examination of the results of the analyses listed in Table 5.11 indicate that:

1. Test sections that were subjected to thin overlay treatment performed better than the control sections by five, four, and five years in the WF, WNF, and DF regions, respectively. While they performed worse in the DNF region by two years. The reason of the latter is that the construction of the overlay caused increases in the IRI of all test sections in the DNF region. For example, the IRI of test section 04B310 increased from 1.3978 m/km before the overlay to 1.5136 m/km after the overlay.
2. Test sections that were subjected to slurry seal performed better than the control sections by one, four, one, and four years in the WF, WNF, DF, and DNF regions, respectively.

Table 5.11 Impacts of various maintenance treatments and control section on pavement performance in terms of RFP based on IRI

Climatic region	Treatment type	Remaining functional period (year)								Difference in RFP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Average	Number of sections	Min	Max	Average	
WF	Thin overlay	19	4	20	16	21	0	19	11	5
WNF		23	8	20	18	29	3	19	14	4
DF		13	5	20	17	13	2	19	12	5
DNF		3	3	13	9	4	3	18	11	-2
WF	Slurry seal	15	0	20	12	21	0	19	11	1
WNF		22	4	20	19	29	3	19	15	4
DF		13	4	20	14	13	2	19	13	1
DNF		2	9	20	15	4	3	18	11	4
WF	Crack seal	18	0	20	11	21	0	19	11	0
WNF		12	1	20	16	29	3	19	14	2
DF		13	3	20	15	13	2	18	12	3
DNF		4	6	20	14	4	3	18	11	3
WF	Aggregate seal coat	16	0	20	13	21	0	19	11	2
WNF		21	14	20	19	29	3	19	15	4
DF		13	1	20	14	13	2	19	13	1
DNF		3	4	10	7	4	3	18	11	-4

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze

3. Test sections that were subjected to crack seal performed better than the control sections by two, three, and three years in the WNF, DF, and DNF regions, respectively. Further, crack sealing has no impact on pavement performance in the WF region.
4. Test sections that were subjected to aggregate seal coat performed better than the control sections by two, four, and one year in the WF, WNF, and DF regions, respectively. While they performed worse in the DNF regions by four years. Once again, the reason of decreasing performance in the DNF regions is construction of the aggregate seal coat, which increased the IRI of two of the three test sections.

For some of the SPS-3 test sections, the LTPP database contains one or more IRI data points before the sections were subjected to maintenance treatments. In order to assess the impact of the BT pavement conditions on the AT pavement performance, for each maintenance treatment type, the RFP values after treatment were plotted against the last collected IRI data point BT. The results are shown in Figures 5.3 through 5.6 for thin overlay, slurry seal, crack seal, and aggregate seal coat, respectively. Although the data in the figures are widely scattered, the general trend is that the higher is the IRI value before treatment, the lower is the RFP after treatment. This finding was expected and supports the notion that maintaining pavement sections in good conditions pays higher dividends than treating deteriorated sections. Nevertheless, the scatter of the data in Figures 5.3 through 5.6 is likely caused by differences in the original pavement cross-sections, pavement materials, roadbed soil, climatic region, and by traffic level. Unfortunately, the number of test sections subjected to the same traffic level bracket is so small such that no decision regarding the impacts of traffic can be made with any level of certainty.

5.5.2 Rut Depth

The calculated minimum, maximum, and average RFP/RSP values based on rut depth data for the SPS-3 test sections that were subjected to the same treatment type and for the associated control sections are listed in Table 5.12. From the table it can be summarized that:

- Test sections subjected to thin overlay performed better than the control sections by seven, eight, seven, and one year in the WF, WNF, DF, and DNF regions respectively.
- Test sections subjected to slurry seal performed better than the control sections by two, five, four, and three years in the WF, WNF, DF, and DNF regions respectively.
- Test sections subjected to crack seal performed better than the control sections by one, five, seven, and two years in the WF, WNF, DF, and DNF regions respectively.
- Test sections subjected to aggregate seal coat performed better than the control sections by three, three, five, and nine years in the WF, WNF, DF, and DNF regions respectively.

Similar to the IRI analyses, the RSP values after treatment were plotted against the last measured rut depth data point BT. The results are shown in Figures D.1 through D.4 of Appendix D. The data in the figures indicate that, higher BT rut depths lead to lower AT RFP/RSP or better performance relative to rut depth after treatment. Once again, the scatter of data in the figures is mainly due to differences in the original pavement cross-sections, pavement materials, roadbed soil, climatic region, and by traffic level.

5.5.3 Alligator cracking

The calculated minimum, maximum, and average RSP values based on alligator cracking for the SPS-3 test sections for the associated control sections are listed in Table 5.13. The results listed in the table indicate that:

- Test sections subjected to thin overlay performed better than the control sections by two years in the WF and WNF regions, while they performed worse by one and nine years in the DF and DNF regions.

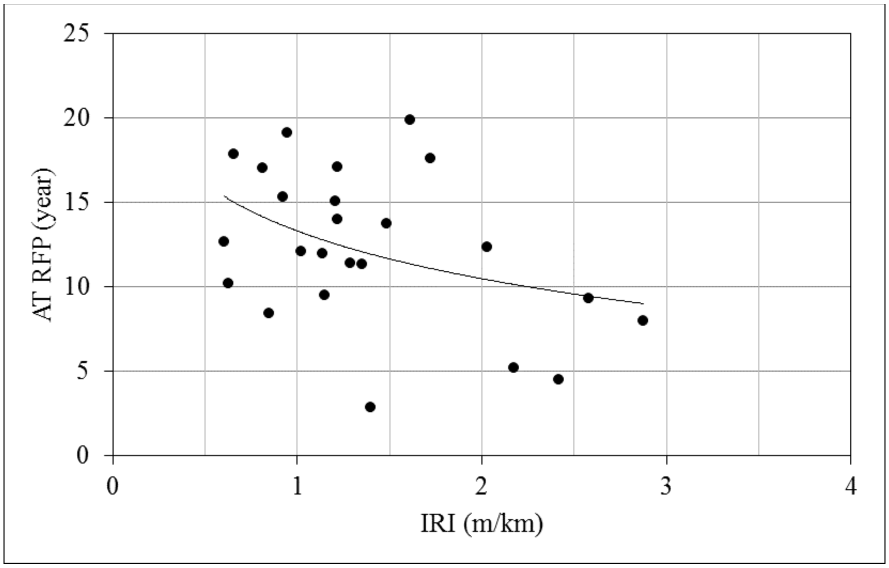


Figure 5.3 After treatment RFP versus before treatment IRI of SPS-3 test sections subjected to thin overlay

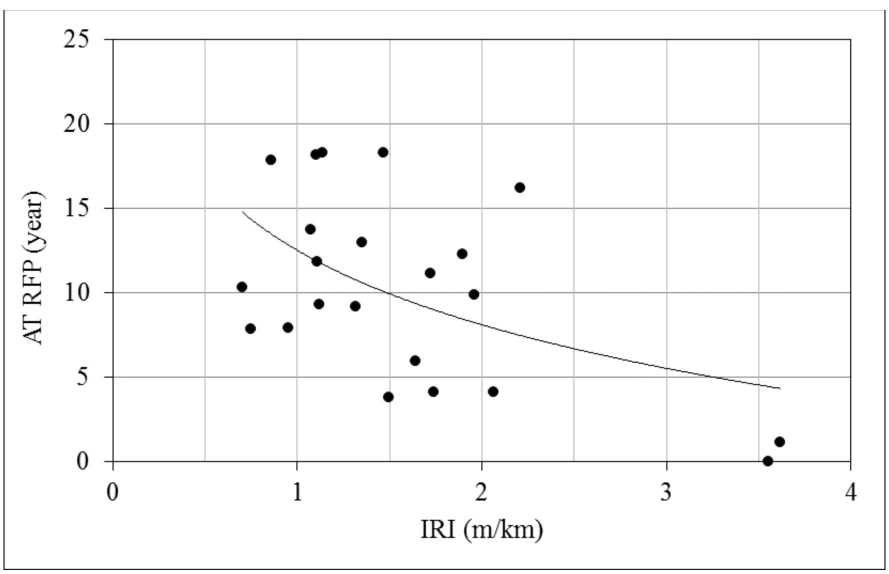


Figure 5.4 After treatment RFP versus before treatment IRI of SPS-3 test sections subjected to slurry seal

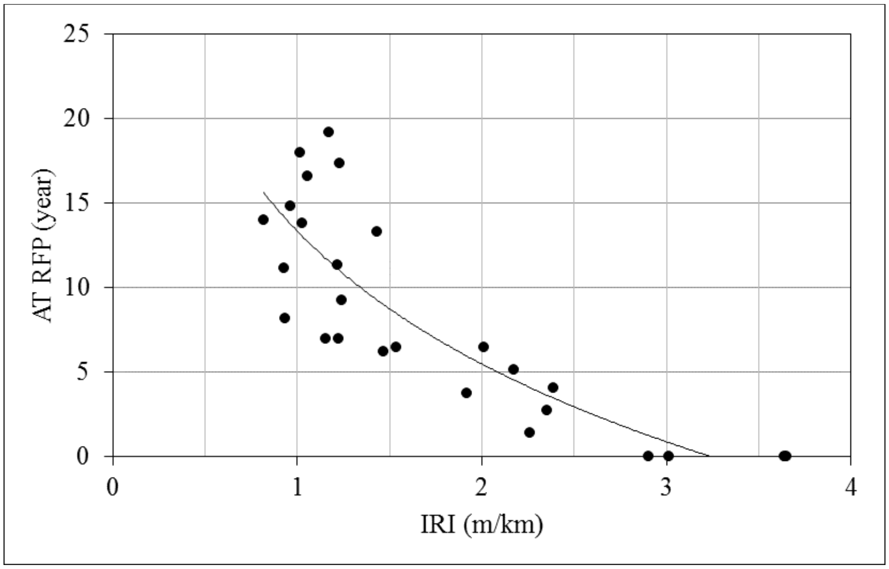


Figure 5.5 After treatment RFP versus before treatment IRI of SPS-3 test sections subjected to crack seal

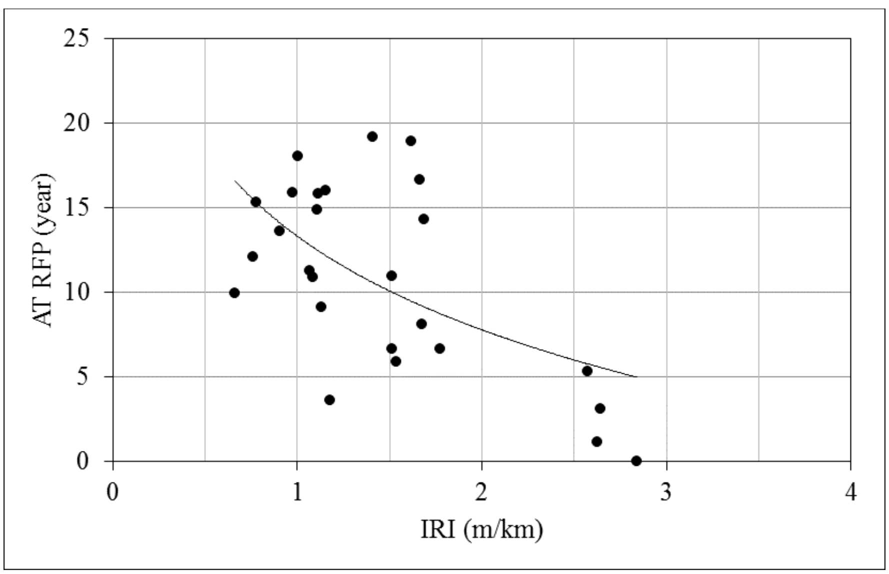


Figure 5.6 After treatment RFP versus before treatment IRI of SPS-3 test sections subjected to aggregate seal coat

Table 5.12 Impacts of various maintenance treatments on pavement performance in terms of RFP/RSP based on RD

Climatic region	Treatment type	Remaining functional/structural period (year)								Difference in RFP/RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Average	Number of sections	Min	Max	Average	
WF	Thin overlay	18	13	20	19	14	0	18	12	7
WNF		21	5	20	19	16	0	19	11	8
DF		8	9	20	19	8	0	19	12	7
DNF		4	0	20	10	3	0	16	11	1
WF	Slurry seal	12	1	20	14	14	0	18	12	2
WNF		19	0	20	16	16	0	19	11	5
DF		10	1	20	16	8	0	19	12	4
DNF		3	1	20	14	3	0	16	11	3
WF	Crack seal	11	0	20	13	14	0	18	12	1
WNF		9	0	20	16	16	0	19	11	5
DF		9	2	20	18	8	0	18	11	7
DNF		3	0	20	13	3	0	16	11	2
WF	Aggregate seal coat	11	0	20	15	14	0	18	12	3
WNF		22	0	20	14	16	0	19	11	3
DF		8	0	20	17	8	0	19	12	5
DNF		2	0	20	20	3	0	16	11	9
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

- Test sections subjected to slurry seal performed worse than the control sections by one, three, and seven years in the WF, DF, and DNF regions respectively, while they performed the same in the WNF region.
- Test sections subjected to crack seal performed better than the control sections by one year in the DF region, while they performed worse by two, one, and 15 years in the WF, WNF, and DNF regions.
- Test sections subjected to aggregate seal coat performed better than the control sections by two, two, and one years in the WF, WNF, and DNF regions respectively, while they performed worse by one year in the DF region.

Similar to the IRI and rut depths, for each treatment type, the RSP values of the test sections after treatment were plotted against the last collected alligator cracking data points BT. The results are shown in Figures D.5 through D.8 of Appendix D. In summary, the data in the four figures indicate that, as the alligator cracking increases, the after treatment RSP values decrease. That is, the data indicate that, on average, treating pavement sections at an early stage pays higher dividends than delayed treatment.

5.5.4 Longitudinal cracking

The calculated minimum, maximum, and average RSP values based on longitudinal cracking for the SPS-3 test sections that were subjected to the same treatment type and located in the same climatic region and for the associated control sections are listed in Table 5.14. The results listed in the table indicate that:

- Test sections subjected to thin overlay performed better than the control sections by one and two years in the DF and DNF regions, while they performed worse than the control sections by three years in the WF region. They performed the same in the WNF region

Table 5.13 Impacts of various maintenance treatments on pavement performance in terms of RSP based on AC

Climatic region	Treatment type	Remaining structural period (year)								Difference in RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Average	Number of sections	Min	Max	Average	
WF	Thin overlay	21	2	20	10	15	0	16	8	2
WNF		24	3	20	11	20	0	17	9	2
DF		11	4	20	11	8	6	18	12	-1
DNF		3	0	15	7	1	16	16	16	-9
WF	Slurry seal	16	0	20	7	15	0	16	8	-1
WNF		30	2	20	10	20	0	17	10	0
DF		10	3	20	9	8	6	18	12	-3
DNF		2	0	18	9	1	16	16	16	-7
WF	Crack seal	10	0	20	6	15	0	16	8	-2
WNF		22	0	20	8	20	0	17	9	-1
DF		11	0	20	13	8	5	18	12	1
DNF		2	0	2	1	1	16	16	16	-15
WF	Aggregate seal coat	15	2	20	10	15	0	16	8	2
WNF		18	4	20	12	20	0	17	10	2
DF		9	6	20	11	8	6	18	12	-1
DNF		2	13	20	17	1	16	16	16	1
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

- Test sections subjected to slurry seal performed better than the control sections by two and three years in the DF and DNF regions, while they performed worse than the control sections by two years in the WF region. They performed the same in the WNF region.
- Test sections subjected to crack seal performed better than the control sections by one year in the WNF region, while they performed worse by five, one, and 11 years in the WF, DF, and DNF regions, respectively.
- Test sections subjected to aggregate seal coat performed better than the control sections by two, four, and seven years in the WNF, DF, and DNF regions respectively, while they performed worse by two years in the WF region.

Once again, for each treatment type, the RSP values of the test sections after treatment were plotted against the last measured longitudinal cracking data point BT as shown in Figures D.9 through D.12 of Appendix D. It can be seen from the figures that, on average, the higher is the longitudinal cracking length before treatments, the lower is the RSP after treatments.

5.5.5 Transverse cracking

The calculated minimum, maximum, and average RSP values based on transverse cracking for the SPS-3 test sections that were subjected to the same treatment type and located in the same climatic region and for the associated control sections are listed in Table 5.15. The data in the table indicate that:

- Test sections subjected to thin overlay performed better by one, one, and 12 years in the WF, DF, and DNF regions, respectively, while they performed the same as the control sections in the WNF region.

- Test sections subjected to slurry seal performed better by two and five years in the DF and DNF regions, while they performed the same as the control sections in the WF and WNF regions.
- Test sections subjected to crack seal performed better than the control sections in the DF region by one year, while they performed the same in the WF and WNF regions respectively. Note that insufficient data were available to make a comparison in the DNF region.
- Test sections subjected to aggregate seal coat performed better by two, one, one, and five years in the WF, WNF, DF, and DNF regions, respectively

For each treatment type, the RSP values of the test sections after treatment were plotted against the last measured transverse cracking data point BT as shown in Figures D.13 through D.16 of Appendix D. It can be seen from the figures that the lower is the cumulative transfer cracks, the higher is the RSP values after treatment.

5.6 Summary, Conclusions, and Recommendations, SPS-3

Table 5.16 provides a summary of the impacts of the four SPS-3 maintenance treatments on the pavement performance. The number in each cell of the table expresses the average increase in the RFP or RSP of the test sections relative to the control sections. It should be noted that the number of sections in the DNF region are too few in number to make any reliable conclusions. Also, in many instances, the control sections were not truly representative of the test sections that have undergone treatments in terms of pavement condition and distress. Nevertheless, the data in the table indicate that:

1. The thin overlay treatment improves the pavement performance relative to IRI and rut depth in WF, WNF, and DF regions. No conclusions can be made in the DNF region because of the limited number of test sections.

Table 5.14 Impacts of various maintenance treatments on pavement performance in terms of RSP based on LC

Climatic region	Treatment type	Remaining structural period (year)								Difference in RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Average	Number of sections	Min	Max	Average	
WF	Thin overlay	23	2	20	9	12	4	19	12	-3
WNF		26	5	20	12	20	0	18	12	0
DF		12	2	20	15	6	5	18	14	1
DNF		2	15	15	15	2	10	16	13	2
WF	Slurry seal	13	3	20	10	12	4	19	12	-2
WNF		30	4	20	13	20	0	18	13	0
DF		10	8	20	16	6	5	18	14	2
DNF		1	16	16	16	2	10	16	13	3
WF	Crack seal	12	0	20	7	12	4	19	12	-5
WNF		14	1	20	13	20	0	18	12	1
DF		7	1	20	13	6	5	18	14	-1
DNF		1	2	2	2	2	10	16	13	-11
WF	Aggregate seal coat	21	3	20	10	12	4	19	12	-2
WNF		19	5	20	14	20	0	18	12	2
DF		9	8	20	18	6	5	18	14	4
DNF		1	20	20	20	2	10	16	13	7
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

Table 5.15 Impacts of various maintenance treatments on pavement performance in terms of RSP based on TC

Climatic regions	Treatment type	Remaining structural period (year)								Difference in RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Average	Number of sections	Min	Max	Average	
WF	Thin overlay	22	1	20	9	18	0	16	8	1
WNF		24	5	20	12	20	3	17	12	0
DF		12	2	20	13	8	0	18	11	1
DNF		2	12	20	16	1	4	4	4	12
WF	Slurry seal	14	0	20	8	18	0	16	8	0
WNF		30	3	20	12	20	3	17	12	0
DF		7	2	20	13	8	0	18	11	2
DNF		1	9	9	9	1	4	4	4	5
WF	Crack seal	14	0	20	8	18	0	16	8	0
WNF		18	0	20	12	20	3	16	12	0
DF		9	0	20	12	8	0	18	11	1
DNF		0	0	0	-	1	4	4	4	NC
WF	Aggregate seal coat	17	0	20	10	18	0	16	8	2
WNF		16	3	20	13	20	3	16	12	1
DF		8	1	20	12	8	0	18	11	1
DNF		1	9	9	9	1	4	4	4	5

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; NC = could not be compared

2. In general, the thin overlay treatment does not improve the pavement performance relative to alligator, longitudinal, and transverse cracking. This is mainly due to the high rate of reflective cracking. Immediately after treatment, all cracks are hidden by the thin overlay.
3. However, one or few years later, most cracks are reflected through the overlay, which implies relatively high rate of deterioration and hence short RSP. The exception is the DNF region, where the 12 year increase in the average RSP of the two test sections relative to the one control section is mainly due to the limited number of sections. That is, the conclusion is not reliable due to the limited number of test sections and control sections.
4. The slurry seal treatment improves the pavement performance relative to IRI and rut depth but does not have much impact on alligator, longitudinal, and transverse cracking. The increase in the RSP based on transverse cracking in the DNF region is likely due to the limited number of sections (one test section and one control section).
5. Crack sealing appears to improve the pavement performance relative to rutting. This was expected because crack sealing decreases water infiltration, which increases the stiffness of the lower pavement layers. The pavement performance relative to IRI was improved in the WNF, DF, and DNF regions. However, it did not improve the pavement performance relative to cracking.
6. The aggregate seal coat appears to improve the pavement performance in all climatic regions in terms of IRI, rut depth, and cracking. This improvement varies from about one to five years. Relative to the IRI, the decrease in the RFP of four years in the DNF region is highly likely due to three reasons; construction quality, the good ride quality of one of the three control sections, and limited number of sections.
7. In general, the worse are the pavement conditions BT, the lower are the AT RFP or RSP.

Table 5.16 Summary of the impact of treatment type on pavement performance relative to the control sections

Treatment type	Condition or distress type	Climatic region			
		WF	WNF	DF	DNF
Thin overlay	IRI	5	4	5	-2
	RD	7	8	7	1
	AC	2	2	-1	-9
	LC	-3	0	1	2
	TC	1	0	1	12
Slurry seal	IRI	1	4	1	4
	RD	2	5	4	3
	AC	-1	0	-3	-7
	LC	-2	0	2	3
	TC	0	0	2	5
Crack seal	IRI	0	2	3	3
	RD	1	5	7	2
	AC	-2	-1	1	-15
	LC	-5	1	-1	-11
	TC	0	0	1	NC
Aggregate seal coat	IRI	2	4	1	-4
	RD	3	3	5	9
	AC	2	2	-1	1
	LC	-2	2	4	7
	TC	2	1	1	5
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; and DNF = dry-no-freeze					
RD = rut depth; AC = alligator cracking; LC = longitudinal cracking; and TC = transverse cracking; NC = could not be compared					

5.7 Impact of Rehabilitation Treatments on Pavement Performance Using LTPP SPS-5 Test Sections

Once again, one of the objectives of this study is to analyze the benefits of the various rehabilitation treatments applied to the LTPP SPS-5 test sections. Unfortunately, for some test sections, the LTPP database does not have enough time series pavement condition and distress data to conduct the analyses. In one scenario, some of the test sections were subjected to a second treatment and only one or two data points are available. In another scenario, the measured IRI, rut depth, and/or cracking data show improvement in the pavement condition and/or distresses over time without treatment. After exhaustive search of the database, it was found that the database has adequate number of time series pavement condition and distress data for the evaluation of the benefits of the following rehabilitation treatments:

1. Thin (2-inch) and thick (4-inch) AC overlay using recycled asphalt mixes.
2. Thin (2-inch) and thick (4-inch) AC overlay using virgin asphalt mixes.
3. Thin (2-inch) and thick (4-inch) mill and fill using recycled asphalt mixes.
4. Thin (2-inch) and thick (4-inch) mill and fill using virgin asphalt mixes.

After identifying the types of treatments that can be analyzed, the time dependent pavement condition and distress data were then organized per treatment type, climatic region, and per pavement condition and distress type. The data were then analyzed and the RFP and RSP values of each treated test section accepted for analyses and the corresponding control and/or linked sections were calculated. For each pavement condition (IRI) and distress type (rut depth and alligator, longitudinal, and transverse cracking) the RFP/RSP of the treatment and the treatment benefits are listed in Tables 5.17 through 5.26. The benefits are listed per climatic region and pavement condition and distress type and are summarized in Table 5.27.

Table 5.17 Impacts of various treatments on pavement performance in terms of RFP based on IRI for virgin AC mixes

Climatic region	State (state code)	Control section RFP (year)	Virgin AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RFP	B1	B2	RFP	B1	B2	RFP	B1	B2	RFP	B1	B2
WF	Maine (23)	17	20	3	20	20	3	20	20	3	20	20	3	20
	Minnesota (27)	5	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	New Jersey (34)	10	20	10	20	20	10	20	20	10	20	20	10	20
	Alberta (81)	16	ND	-	ND	20	4	20	20	4	20	20	4	20
	Manitoba (83)	ND	20	-	18	20	-	19	NS	-	NS	20	-	20
WNF	Alabama (1)	15	20	5	18	20	5	20	20	5	20	20	5	20
	Florida (12)	12	20	8	20	20	8	20	20	8	20	20	8	20
	Georgia (13)	NCS	20	-	20	20	-	15	20	-	18	20	-	12
	Maryland (24)	18	20	2	11	15	-3	12	20	2	20	20	2	20
	Mississippi (28)	13	20	7	6	20	7	20	20	7	12	20	7	20
	Missouri (29)	ND	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	ND	20	-	10	NS	-	NS	NS	-	NS	NS	-	NS
DF	Colorado (8)	ND	NS	-	NS	20	-	20	17	-	ND	20	-	ND
	Montana (30)	4	16	12	6	20	16	20	20	16	20	20	16	NA
DNF	Arizona (4)	17	20	3	20	20	3	20	20	3	20	20	3	20
	California (6)	0	10	10	6	20	20	10	20	20	15	20	20	20
	New Mexico (35)	ND	20	-	ND	20	-	ND	20	-	ND	20	-	ND

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in functional period; B2 = functional condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.18 Impacts of various treatments on pavement performance in terms of RFP based on IRI for recycled AC mixes

Climatic region	State (state code)	Control Section RFP (year)	Recycled AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RFP	B1	B2	RFP	B1	B2	RFP	B1	B2	RFP	B1	B2
WF	Maine (23)	17	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS
	Minnesota (27)	5	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	New Jersey (34)	10	20	10	20	20	10	20	20	10	20	20	10	20
	Alberta (81)	16	20	4	18	20	4	20	20	4	17	20	4	20
	Manitoba (83)	ND	20	-	20	NS	-	NS	20	-	20	20	-	20
WNF	Alabama (1)	15	20	5	17	20	5	20	20	5	20	20	5	10
	Florida (12)	12	20	8	16	20	8	20	20	8	20	20	8	20
	Georgia (13)	NCS	20	-	15	20	-	15	20	-	14	20	-	11
	Maryland (24)	18	ND	-	ND	20	2	15	20	2	12	20	2	20
	Mississippi (28)	13	20	7	20	20	7	20	20	7	20	20	7	20
	Missouri (29)	ND	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	ND	20	-	15	20	-	20	20	-	20	20	-	16
DF	Colorado (8)	ND	20	-	20	NS	-	NS	20	-	ND	20	-	20
	Montana (30)	4	12	8	6	20	16	20	15	11	3	20	16	20
DNF	Arizona (4)	17	13	-4	8	20	3	20	16	-1	14	20	3	20
	California (6)	0	11	11	10	20	20	10	9	9	8	20	20	18
	New Mexico (35)	ND	20	-	ND	20	-	ND	20	-	ND	20	-	ND

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in functional period; B2 = functional condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.19 Impacts of various treatments on pavement performance in terms of RFP/RSP based on RD for virgin AC mixes

Climatic region	State (state code)	Control section RFP/RSP (year)	Virgin AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RFP/ RSP	B1	B2	RFP/ RSP	B1	B2	RFP/ RSP	B1	B2	RFP/ RSP	B1	B2
WF	Maine (23)	0	20	20	20	12	11	15	8	8	13	10	10	11
	Minnesota (27)	16	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS
	New Jersey (34)	NS	20	-	20	20	-	20	NS	-	NS	NS	-	NS
	Alberta (81)	ND	ND	-	ND	20	-	ND	20	-	ND	20	-	ND
	Manitoba (83)	ND	20	-	ND	20	-	ND	20	-	ND	20	-	ND
WNF	Alabama (1)	NS	20	-	ND	20	-	ND	20	-	ND	20	-	ND
	Florida (12)	12	20	8	20	20	8	20	20	8	20	20	8	20
	Georgia (13)	NCS	20	-	20	20	-	20	20	-	20	20	-	20
	Maryland (24)	ND	NS	-	NS	20	-	3	NS	-	NS	20	-	20
	Mississippi (28)	0	15	15	20	4	4	5	8	8	13	3	3	5
	Missouri (29)	NS	20	-	20	20	-	13	20	-	20	20	-	20
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	14	20	6	20	20	6	20	20	6	18	20	6	18
DF	Colorado (8)	NS	20	-	13	20	-	13	20	-	20	18	-	20
	Montana (30)	NS	20	-	20	14	-	7	10	-	10	17	-	13
DNF	Arizona (4)	NS	20	-	ND	NS	-	NS	NS	-	NS	NS	-	NS
	California (6)	ND	20	-	6	20	-	20	20	-	20	20	-	20
	New Mexico (35)	ND	20	-	ND	20	-	ND	20	-	ND	20	-	ND

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.20 Impacts of various treatments on pavement performance in terms of RFP/RSP based on RD for recycled AC mixes

Climatic region	State (state code)	Control section RFP/RSP (year)	Recycled AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RFP/ RSP	B1	B2	RFP/ RSP	B1	B2	RFP/ RSP	B1	B2	RFP/ RSP	B1	B2
WF	Maine (23)	0	15	15	16	14	14	15	12	12	18	10	10	15
	Minnesota (27)	16	20	4	20	NS	-	NS	20	4	20	NS	-	NS
	New Jersey (34)	NS	20	-	20	NS	-	NS	NS	-	NS	NS	-	NS
	Alberta (81)	ND	NS	-	NS	20	-	ND	20	-	ND	NS	-	NS
	Manitoba (83)	ND	20	-	ND	20	-	ND	20	-	ND	20	-	ND
WNF	Alabama (1)	NS	20	-	ND	20	-	ND	20	-	ND	20	-	ND
	Florida (12)	12	20	8	20	20	8	11	20	8	20	20	8	20
	Georgia (13)	NCS	20	-	20	20	-	20	20	-	20	20	-	20
	Maryland (24)	ND	4	-	1	2	-	0	9	-	2	3	-	1
	Mississippi (28)	0	9	9	20	6	6	12	9	9	20	4	4	9
	Missouri (29)	NS	20	-	20	20	-	3	20	-	20	20	-	1
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	14	20	6	20	20	6	20	20	6	20	20	6	20
DF	Colorado (8)	NS	19	-	6	20	-	8	18	-	20	13	-	20
	Montana (30)	NS	16	-	18	20	-	20	12	-	10	20	-	20
DNF	Arizona (4)	NS	20	-	ND	20	-	ND	20	-	ND	NS	-	NS
	California (6)	ND	20	-	20	20	-	11	20	-	20	20	-	20
	New Mexico (35)	ND	NS	-	NS	20	-	ND	20	-	ND	20	-	ND

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.21 Impacts of various treatments on pavement performance in terms of RSP based on AlC for virgin AC mixes

Climatic region	State (state code)	Control Section RSP (year)	Virgin AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	10	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Minnesota (27)	16	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	New Jersey (34)	ND	20	-	20	20	-	15	20	-	13	18	-	10
	Alberta (81)	ND	ND	-	ND	13	-	ND	11	-	ND	14	-	ND
	Manitoba (83)	ND	9	-	0	13	-	0	11	-	0	13	-	0
WNF	Alabama (1)	0	20	20	0	20	20	15	20	20	20	20	20	20
	Florida (12)	12	20	8	11	20	8	20	20	8	20	19	8	20
	Georgia (13)	NCS	20	-	9	ND	-	ND	ND	-	ND	20	-	10
	Maryland (24)	ND	ND	-	ND	ND	-	ND	20	-	20	20	-	20
	Mississippi (28)	16	12	-4	7	10	-6	9	10	-6	5	9	-7	9
	Missouri (29)	NS	ND	-	ND	8	-	6	9	-	8	10	-	7
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	NS	-	NS	NS	-	NS	ND	-	ND	20	-	NS
DF	Colorado (8)	ND	6	-	4	7	-	3	6	-	4	8	-	1
	Montana (30)	ND	NS	-	NS	ND	-	ND	20	-	20	ND	-	ND
DNF	Arizona (4)	ND	9	-	ND	20	-	ND	20	-	ND	ND	-	ND
	California (6)	ND	5	-	ND	11	-	ND	8	-	ND	11	-	ND
	New Mexico (35)	ND	12	-	5	ND	-	ND	20	-	20	16	-	11

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.22 Impacts of various treatments on pavement performance in terms of RSP based on AlC for recycled AC mixes

Climatic region	State (state code)	Control section RSP (year)	Recycled AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	10	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Minnesota (27)	16	ND	-	ND	ND	-	ND	20	4	-	ND	-	ND
	New Jersey (34)	ND	11	-	19	15	-	0	12	-	0	17	-	1
	Alberta (81)	ND	7	-	ND	6	-	ND	7	-	ND	10	-	ND
	Manitoba (83)	ND	7	-	0	7	-	0	10	-	0	12	-	0
WNF	Alabama (1)	0	16	16	4	20	20	20	20	20	10	20	20	20
	Florida (12)	12	20	8	16	20	8	20	20	8	20	20	8	20
	Georgia (13)	-	20	-	20	ND	-	ND	20	-	16	ND	-	ND
	Maryland (24)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Mississippi (28)	16	7	-10	0	11	-5	5	6	-10	0	9	-8	4
	Missouri (29)	NS	ND	-	ND	ND	-	ND	20	-	17	ND	-	ND
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	20	-	NS	20	-	NS	20	-	NS	20	-	NS
DF	Colorado (8)	ND	6	-	0	6	-	4	20	-	0	7	-	5
	Montana (30)	ND	ND	-	ND	3	-	7	4	-	5	6	-	6
DNF	Arizona (4)	ND	4	-	ND	13	-	ND	15	-	ND	20	-	ND
	California (6)	ND	4	-	ND	8	-	ND	3	-	ND	20	-	ND
	New Mexico (35)	ND	20	-	0	10	-	8	15	-	0	10	-	9

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.23 Impacts of various treatments on pavement performance in terms of RSP based on LC for virgin AC mixes

Climatic region	State (state code)	Control section RSP (year)	Virgin AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	8	9	0	8	9	1	8	9	1	8	9	1	9
	Minnesota (27)	9	6	-3	2	11	2	6	8	-1	5	8	-1	6
	New Jersey (34)	ND	20	-	NA	15	-	NA	18	-	NA	12	-	NA
	Alberta (81)	ND	ND	-	ND	20	-	ND	20	-	ND	17	-	ND
	Manitoba (83)	ND	20	-	0	14	-	0	20	-	0	17	-	0
WNF	Alabama (1)	ND	20	-	6	20	-	0	20	-	8	20	-	0
	Florida (12)	ND	20	-	0	20	-	0	17	-	14	20	-	14
	Georgia (13)	NCS	11	-	0	14	-	0	13	-	0	14	-	0
	Maryland (24)	ND	ND	-	ND	ND	-	ND	13	-	0	12	-	3
	Mississippi (28)	9	20	11	0	12	2	1	14	5	5	ND	-	ND
	Missouri (29)	4	5	1	5	10	6	10	10	5	10	18	13	19
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	11	-	ND	20	-	ND	17	-	ND	20	-	ND
DF	Colorado (8)	ND	5	-	4	6	-	4	7	-	5	9	-	6
	Montana (30)	ND	NS	-	NS	ND	-	ND	10	-	9	ND	-	ND
DNF	Arizona (4)	ND	20	-	ND	18	-	ND	20	-	ND	20	-	ND
	California (6)	ND	11	-	ND	11	-	ND	10	-	ND	16	-	ND
	New Mexico (35)	ND	12	-	7	10	-	8	11	-	5	10	-	8

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.24 Impacts of various treatments on pavement performance in terms of RSP based on LC for recycled AC mixes

Climatic region	State (state code)	Control section RSP (year)	Recycled AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	8	10	2	10	9	0	8	10	2	10	9	1	9
	Minnesota (27)	9	9	0	3	20	11	11	9	1	7	13	5	10
	New Jersey (34)	ND	NS	-	NS	12	-	NA	NS	-	NS	12	-	NA
	Alberta (81)	ND	13	-	ND	14	-	ND	12	-	ND	13	-	ND
	Manitoba (83)	ND	NS	-	NS	20	-	0	20	-	0	16	-	0
WNF	Alabama (1)	ND	20	-	20	20	-	0	20	-	0	20	-	0
	Florida (12)	ND	20	-	20	19	-	19	20	-	1	20	-	18
	Georgia (13)	NCS	11	-	1	14	-	0	13	-	0	14	-	0
	Maryland (24)	ND	7	-	5	ND	-	ND	16	-	7	20	-	6
	Mississippi (28)	9	20	11	4	20	11	0	9	0	7	14	5	0
	Missouri (29)	4	13	9	10	10	5	7	13	9	6	13	8	11
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	10	-	ND	12	-	ND	12	-	ND	12	-	ND
DF	Colorado (8)	ND	7	-	4	6	-	4	7	-	6	6	-	5
	Montana (30)	ND	ND	-	ND	ND	-	ND	ND	-	ND	19	-	8
DNF	Arizona (4)	ND	NS	-	NS	19	-	ND	20	-	ND	18	-	ND
	California (6)	ND	10	-	ND	10	-	ND	8	-	ND	9	-	ND
	New Mexico (35)	ND	10	-	9	8	-	6	10	-	6	8	-	5

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.25 Impacts of various treatments on pavement performance in terms of RSP based on TC for virgin AC mixes

Climatic region	State (state code)	Control section RSP (year)	Virgin AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	NS	ND	-	ND	11	-	10	11	-	10	ND	-	ND
	Minnesota (27)	16	2	-15	5	13	-4	15	6	-10	13	13	-3	14
	New Jersey (34)	ND	18	-	5	20	-	15	20	-	13	20	-	14
	Alberta (81)	ND	ND	-	ND	20	-	ND	17	-	ND	11	-	ND
	Manitoba (83)	ND	20	-	0	10	-	2	20	-	0	14	-	0
WNF	Alabama (1)	10	20	10	0	20	10	11	20	10	9	20	10	4
	Florida (12)	ND	19	-	7	20	-	7	20	-	0	20	-	2
	Georgia (13)	NCS	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Maryland (24)	ND	ND	-	ND	ND	-	ND	20	-	5	20	-	20
	Mississippi (28)	8	12	4	6	11	3	9	14	6	5	13	5	11
	Missouri (29)	NS	9	-	8	ND	-	ND	10	-	9	14	-	11
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	12	-	ND	20	-	ND	20	-	ND	20	-	ND
DF	Colorado (8)	ND	10	-	6	10	-	8	15	-	5	NS	-	NS
	Montana (30)	ND	20	-	20	20	-	20	20	-	20	20	-	20
DNF	Arizona (4)	ND	14	-	ND	19	-	ND	19	-	ND	19	-	ND
	California (6)	ND	9	-	ND	12	-	ND	9	-	ND	13	-	ND
	New Mexico (35)	ND	15	-	10	ND	-	ND	12	-	11	17	-	16
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable														

Table 5.26 Impacts of various treatments on pavement performance in terms of RSP based on TC for recycled AC mixes

Climatic region	State (state code)	Control section RSP (year)	Recycled AC mix											
			Overlay						Mill and Fill					
			Thin			Thick			Thin			Thick		
			RSP	B1	B2	RSP	B1	B2	RSP	B1	B2	RSP	B1	B2
WF	Maine (23)	NS	ND	-	ND	ND	-	ND	20	-	9	ND	-	ND
	Minnesota (27)	17	8	-8	5	13	-4	9	10	-7	7	9	-8	8
	New Jersey (34)	ND	13	-	1	17	-	8	20	-	0	20	-	10
	Alberta (81)	ND	12	-	ND	14	-	ND	9	-	ND	9	-	ND
	Manitoba (83)	ND	17	-	0	17	-	0	20	-	0	8	-	6
WNF	Alabama (1)	10	19	9	0	20	10	7	20	10	2	20	10	7
	Florida (12)	ND	20	-	14	ND	-	ND	20	-	10	20	-	20
	Georgia (13)	NCS	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Maryland (24)	ND	14	-	10	8	-	7	20	-	20	ND	-	ND
	Mississippi (28)	8	8	0	6	9	1	3	10	2	7	10	2	5
	Missouri (29)	NS	ND	-	ND	ND	-	ND	20	-	15	ND	-	ND
	Oklahoma (40)	ND	ND	-	ND	ND	-	ND	ND	-	ND	ND	-	ND
	Texas (48)	NS	11	-	ND	15	-	ND	13	-	ND	17	-	ND
DF	Colorado (8)	ND	6	-	4	ND	-	ND	6	-	4	ND	-	ND
	Montana (30)	ND	ND	-	ND	20	-	20	ND	-	ND	NS	-	NS
DNF	Arizona (4)	ND	NS	-	NS	8	-	ND	9	-	ND	11	-	ND
	California (6)	ND	10	-	ND	10	-	ND	8	-	ND	8	-	ND
	New Mexico (35)	ND	17	-	3	15	-	8	17	-	2	11	-	9

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; "-" = could not be estimated; Thin = 2-inch; Thick = 4-inch; B1= change in structural period; B2 = structural condition reoccurrence period; ND = no data ; NS = model has a negative slope; NA = not applicable

Table 5.27 Summary of benefits of various rehabilitation treatments

Treatment type	Thickness (inch)	Statistic	Condition		Distress									
			IRI		Rut depth		Cracking					
							Alligator		Longitudinal		Transverse	
			B1	B2	B1	B2	B1	B2	B1	B2	B1	B2
Overlay, virgin AC mix	2	Min	2	6	6	6	-4	0	-3	0	-15	0
		Max	12	20	20	20	20	20	11	8	10	20
		Average	7	14	12	18	8	7	2	3	0	7
	4	Min	-3	10	4	3	-6	0	1	0	-4	2
		Max	20	20	11	20	20	20	6	10	10	20
		Average	7	18	7	14	7	10	3	4	3	11
Overlay, recycled AC mix	2	Min	-4	6	4	1	-10	0	0	1	-8	0
		Max	11	20	15	20	16	20	11	20	9	14
		Average	6	15	8	17	5	7	5	9	0	5
	4	Min	2	10	6	0	-5	0	0	0	-4	0
		Max	20	20	14	20	20	20	11	19	10	20
		Average	8	18	9	12	8	8	7	6	2	8
Mill and fill, virgin AC mix	2	Min	2	12	6	10	-6	0	-1	0	-10	0
		Max	20	20	8	20	20	20	5	14	10	20
		Average	8	19	8	17	7	13	2	6	2	8
	4	Min	2	12	3	5	-7	0	-1	0	-3	0
		Max	20	20	10	20	20	20	13	19	10	20
		Average	8	19	7	17	7	11	4	6	4	11
Mill and fill, recycled AC mix	2	Min	-1	3	4	2	-10	0	0	0	-7	0
		Max	11	20	12	20	20	20	9	10	10	20
		Average	6	16	8	17	6	7	3	5	2	7
	4	Min	2	10	4	1	-8	0	1	0	-7	5
		Max	20	20	10	20	20	20	8	18	10	20
		Average	8	18	7	15	7	8	5	6	2	9

B1 = Changes in functional or structural period (CFP/CSP) in years

B2 = Functional or structural condition re-occurrence period (FCROP/SCROP) in years

Note that the treatment benefits in the tables are expressed in the following terms:

1. The differences in the RFP or the RSP values of the treated and the control section.
2. CROP, which the time in years for the treated pavement section to accumulate the same condition and distress as those existed immediately before treatment. This time is called herein the Condition Re-occurrence Period. CROP is the same as treatment life (TL) previously defined by Dawson et al., 2011

The benefits summary, listed in Table 5.27, are divided based on the pavement condition and distress type and on the treatment type. However, the discussion below is based on the benefits relative to the pavement condition and distress type.

1. IRI – The benefits data listed in Table 5.27 under the heading IRI indicate that the averages of the CFP (labeled B1 in the table) of all eight treatments are similar and equal about seven years. This was expected because a proper construction of 2 and 4-inch overlays and 2 and 4-inch mill and fill treatments result in smooth pavement surface and almost the same rate of deterioration. Further, the average FCROP in years of any of the eight treatments is about seventeen years. That is, seventeen years after applying any of the eight treatments, the IRI of the treated pavement will be the same as that just before treatment.
2. Rut Depth – The benefits data listed in Table 5.27 under the heading rut depth indicate that the B1 of seven of the eight treatments are almost the same; a gain in the RSP of the pavement sections of about seven years. Once again, this was expected because a proper construction of the 2 and 4-inch overlays and the 2 and 4-inch mill and fill treatments result in even pavement surface (no rutting) and almost even compaction of the AC overlay (almost the same deterioration rate). Further, the average structural period of the virgin AC mix is about one year higher than the recycled AC mixes. The average structural period of each

treatment using virgin mix is seventeen years, while it is sixteen years for the recycled mix; statistically the same.

3. Alligator Cracking – The benefits data listed in Table 5.27 under the heading alligator cracking indicate that the B1 of the eight treatments vary slightly depending on the thickness of the overlay and the type of the AC mix. On average, each treatment causes an increase in the RSP of about six years (this varies from a high of twenty years to a low of negative ten years). The latter is mainly due to the condition of the control sections; no alligator cracking. Thus, the minimum and maximum CSP values should not be taken seriously, they are for information only. The average CSP, on the other hand, is a good measure of the benefits of each treatment. Further, the average structural period of the 2-inch thick virgin AC overlay is one to three years lower than the 4-inch thick virgin AC overlay. The type of AC mix (virgin and recycled) appears not to impact the SCROP.
4. Longitudinal Cracking – The benefits data listed in Table 5.27 under the heading longitudinal cracking indicate that the about 3 years. The 2 and 4-inch thick overlays and mill and fill using virgin and recycled AC mixes appears to have the lowest CSP values (two to four years) while the CSP for the recycled mixes is about two years higher. Further, the average SCROP of each of the four mill and fill treatments is about six years.
5. Transverse Cracking – The benefits data listed in Table 5.27 under the heading transverse cracking vary and depend on the thickness of the AC overlay. The 2-inch AC overlay yields zero CSP whereas the 4-inch AC overlay yields, on average, CSP of three years. This was expected because the thin 2-inch overlay has minor resistance to reflective cracking. The average SCROP of the 2-inch overlay or mill and fill is about seven years whereas the average SCROP of the 4-inch overlay or mill and fill is about ten years.

5.8 Summary, Conclusions and Recommendations, SPS-5

Based on data availability in the LTPP database, eight rehabilitation treatments are included in the analyses of the treatment benefits. The benefits were estimated by comparing the RFP and the RSP of the test sections and the RFP and the RSP (CFP/CSP) of the control or linked sections. In addition, the FCROP/SCROP (the time in years from the treatment to the year during which the pavement condition or distresses are the same as those before treatment) were also used as calculated indicators of benefits. Based on the results of the analyses, the following conclusions were drawn:

1. On average, the impact of 2 and 4-inch virgin or recycled AC overlay on the pavement performance is almost the same.
2. The two inch AC overlay (virgin or recycled mix) does not provide a long-term remediation of transverse cracking. The cracks in the lower pavement structure will typically reflect through the overlay in few years.
3. On average, the benefits of the two inch AC overlay relative to alligator cracking is slightly less than the 4-inch overlay.
4. The minimum or maximum CFP or CSP should not be used as indicators of benefits. The values are also a function of the conditions and distresses of the control or linked sections.

Based on the results of the data, it is strongly recommended that:

1. A solid criterion be established for the selection of the control sections. Such criterion should be based on the similarity of the pavement condition and distresses, traffic, and material types to the test sections. Perhaps, each control or linked section should border the test section in question. Ideally, the roughness, rut depth, cracking, and any other condition measures of the control and test sections before treatment should be similar.

2. The history of the selected control or linked section and the test sections should be obtained and kept in the database. This information should include construction and treatment history as well as pavement condition and distress data.
3. The pavement condition and distress data be measured no more than one month before the application of a treatment and no more than one month after the completion of the treatment.
4. The pavement condition and distress data be collected more frequently (once a year or less) and for a longer time period (six years is recommended) before the treatment is applied.

5.9 Impacts of Pavement Treatments on Pavement Performance Using the LTPP GPS-6 Test Sections

The LTPP GPS-6 experiment contains flexible pavement test sections that were overlain prior to their assignment into the LTPP program. The experiment also includes test sections that were moved from other LTPP experiments after they were subjected to either AC overlay or mill and fill treatments. The test sections in the GPS-6 experiment are classified as GPS-6A, GPS-6B, GPS-6C, GPS-6D, and GPS-6S. Each of the classifications is explained below.

1. GPS-6A – The test sections under this classification are part of the original LTPP design. They were subjected to AC overlay prior to their assignment into the LTPP program.
2. GPS-6B – The test sections under this classification are also part of the original LTPP design. They were subjected to AC overlay following assignment into the LTPP program.
3. GPS-6C, -6D, and -6S – The test sections under these classifications do not have an experimental design associated with them. They were moved to either GPS-6C, -6D, or -6S classification from other LTPP experiments after they were subjected to rehabilitation actions. The specific GPS-6 classification depends on the type of pavement rehabilitation as detailed below:

- If the test sections from other LTPP experiments were overlain with recycled AC mixes, they were moved into the GPS-6C classification.
- If the test sections from other LTPP experiments were overlain using virgin AC mixes, they are moved into the GPS-6D classification.
- If the test sections from other LTPP experiments were milled and filled using virgin or recycled AC mixes, they are moved into the GPS-6S classification.

After an extensive search of the database, all of the test sections in the GPS-6 experiment that have three or more BT and/or three or more AT time series pavement condition and/or distress data points were grouped according to the following variables:

- Two treatment types (AC overlay and mill and fill)
- AC mix type (virgin and recycled)
- Thickness types (thin $\leq$ 2.5 inches and thick > 2.5 inches)
- Four climatic regions (WF, WNF, DF, and DNF)
- One pavement condition (IRI)
- Four pavement distress types

Therefore, the analyses were conducted to assess the impacts of each treatment type and AC mix type and thickness on the pavement performance (IRI, rut depth, and cracking) in each climatic region using the RFP and RSP of each treated test section before and after treatment.

Further, for each test section, the treatment benefits were expressed in terms of the changes in the functional and structural periods (CFP or CSP) which is the difference between the AT RFP or RSP and the BT RFP or RSP, and the minimum and maximum CFP and CSP values and their averages for all test sections located in the same climatic region were calculated and are listed in

Tables 5.28 through 5.32 depending on the pavement condition and distress type. The data in the five tables are discussed below per pavement condition and distress type.

5.9.1 IRI

The data in Table 5.28 indicate that on average:

1. The thin and thick overlays using virgin AC mix extended the pavement functional period by about eleven and thirteen years, respectively.
2. The thick overlays using recycled AC mix extended the pavement functional period by thirteen years in the WF region and by eight years in the WNF region. The construction of this overlay type on the single test section in the DF region caused six years loss in the pavement functional period. The reason is the rough pavement surface after construction.
3. The CFP values of the thin mill and fill treatment using virgin AC mix are four, seven, eleven, and thirteen years in the WF, WNF, DF, and DNF regions, respectively. While the CFP values of the thick mill and fill treatment using virgin AC mixes are nineteen, nine, and twelve years in the WF, WNF, and DNF regions, respectively.
4. The thin mill and fill treatment using recycled AC mix extended the pavement functional period by about twelve years in the WF and WNF regions. Whereas, the thick mill and fill treatment using recycled AC mix extended the pavement functional period by about thirteen years in the WF, WNF, and DNF regions, respectively.

Table 5.28 Impacts of various treatments on pavement performance in terms of CFP based on IRI

Treatment type	Mix type	Thickness	WF No.	WF CFP (year) Min	WF CFP (year) Max	WF CFP (year) Avg	WNF No.	WNF CFP (year) Min	WNF CFP (year) Max	WNF CFP (year) Avg	DF No.	DF CFP (year) Min	DF CFP (year) Max	DF CFP (year) Avg	DNF No.	DNF CFP (year) Min	DNF CFP (year) Max	DNF CFP (year) Avg
Overlay	Virgin	Thin	6	4	20	11	16	6	17	10	3	6	17	12	0	0	0	-
		Thick	6	5	20	13	5	10	14	12	4	3	20	13	1	14	14	14
	Recycled	Thin	0	0	0	-	4	2	20	10	0	0	0	-	0	0	0	-
		Thick	1	13	13	13	3	4	14	8	1	-6	-6	-6	0	0	0	-
Mill and Fill	Virgin	Thin	4	-4	9	4	19	-7	12	7	3	6	14	11	1	13	13	13
		Thick	1	19	19	19	4	4	14	9	0	0	0	-	7	5	20	12
	Recycled	Thin	2	10	13	12	2	11	16	13	0	0	0	-	0	0	0	-
		Thick	3	10	20	15	7	3	19	12	0	0	0	-	1	13	13	13

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (> 2.5 inch); CFP = Change in functional period

Table 5.29 Impacts of various treatments on pavement performance in terms of CFP/CSP based on rut depth

Treatment type	Mix type	Thickness	WF No.	WF CFP/CSP (year) Min	WF CFP/CSP (year) Max	WF CFP/CSP (year) Avg	WNF No.	WNF CFP/CSP (year) Min	WNF CFP/CSP (year) Max	WNF CFP/CSP (year) Avg	DF No.	DF CFP/CSP (year) Min	DF CFP/CSP (year) Max	DF CFP/CSP (year) Avg	DNF No.	DNF CFP/CSP (year) Min	DNF CFP/CSP (year) Max	DNF CFP/CSP (year) Avg
Overlay	Virgin	Thin	6	9	20	13	12	-2	20	10	1	8	8	8	0	0	0	-
		Thick	6	5	20	13	3	8	20	12	3	-2	9	5	2	10	13	9
	Recycled	Thin	0	0	0	-	2	4	10	7	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	1	14	14	14	0	0	0	-	0	0	0	-
Mill and Fill	Virgin	Thin	11	1	20	11	20	0	20	16	2	12	16	14	0	0	0	-
		Thick	5	3	20	13	2	20	20	20	0	0	0	-	6	2	15	9
	Recycled	Thin	0	0	0	-	2	11	20	15	0	0	0	-	0	0	0	-
		Thick	1	-5	-5	-5	0	0	0	-	0	0	0	-	0	0	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (> 2.5 inch); CFP/CSP = Change in functional/structural period

Table 5.30 Impacts of various treatments on pavement performance in terms of CSP based on AlC

Treatment type	Mix type	Thickness	WF No.	WF CSP Min	WF CSP Max	WF CSP Avg	WNF No.	WNF CSP Min	WNF CSP Max	WNF CSP Avg	DF No.	DF CSP Min	DF CSP Max	DF CSP Avg	DNF No.	DNF CSP Min	DNF CSP Max	DNF CSP Avg
Overlay	Virgin	Thin	3	11	20	15	4	5	20	13	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	2	8	13	10	0	0	0	-	1	6	6	6
	Recycled	Thin	0	0	0	-	1	4	4	4	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	1	10	10	10	0	0	0	-	0	0	0	-
Mill and Fill	Virgin	Thin	3	7	8	7	5	0	20	6	1	11	11	11	0	0	0	-
		Thick	0	0	0	-	1	4	4	4	0	0	0	-	2	12	17	15
	Recycled	Thin	0	0	0	-	0	0	0	-	0	0	0	-	0	0	0	-
		Thick	1	14	14	14	2	6	17	12	0	0	0	-	0	0	0	-

No. = number of test sections; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (> 2.5 inch); CSP = Change in structural period

Table 5.31 Impacts of various treatments on pavement performance in terms of CSP based on LC

Treatment type	Mix type	Thickness	WF No.	WF CSP Min	WF CSP Max	WF CSP Avg	WNF No.	WNF CSP Min	WNF CSP Max	WNF CSP Avg	DF No.	DF CSP Min	DF CSP Max	DF CSP Avg	DNF No.	DNF CSP Min	DNF CSP Max	DNF CSP Avg
Overlay	Virgin	Thin	2	0	18	9	5	-3	20	7	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	2	5	8	7	0	0	0	-	0	0	0	-
	Recycled	Thin	0	0	0	-	1	3	3	3	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	1	5	5	5	0	0	0	-	0	0	0	-
Mill and Fill	Virgin	Thin	4	-3	5	0	16	-10	20	5	2	10	12	11	0	0	0	-
		Thick	0	0	0	-	1	14	14	14	0	0	0	-	2	0	12	6
	Recycled	Thin	0	0	0	-	1	10	10	10	0	0	0	-	0	0	0	-
		Thick	1	17	17	17	2	14	14	14	0	0	0	-	0	0	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (> 2.5 inch); CSP = Change in structural period

Table 5.32 Impacts of various treatments on pavement performance in terms of CSP based on TC

Treatment type	Mix type	Thickness	WF No.	WF CSP (year) Min	WF CSP (year) Max	WF CSP (year) Avg	WNF No.	WNF CSP (year) Min	WNF CSP (year) Max	WNF CSP (year) Avg	DF No.	DF CSP (year) Min	DF CSP (year) Max	DF CSP (year) Avg	DNF No.	DNF CSP (year) Min	DNF CSP (year) Max	DNF CSP (year) Avg
Overlay	Virgin	Thin	3	5	12	8	10	-2	17	6	0	0	0	-	0	0	0	-
		Thick	2	8	20	14	3	7	14	11	0	0	0	-	1	4	4	4
	Recycled	Thin	0	0	0	-	1	3	3	3	0	0	0	-	0	0	0	-
		Thick	0	0	0	-	1	3	3	3	0	0	0	-	0	0	0	-
Mill and Fill	Virgin	Thin	0	0	0	-	5	-6	16	5	1	3	3	3	0	0	0	-
		Thick	0	0	0	-	1	5	5	5	0	0	0	-	3	0	12	7
	Recycled	Thin	0	0	0	-	2	10	11	11	0	0	0	-	0	0	0	-
		Thick	2	8	11	9	3	8	16	13	0	0	0	-	0	0	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (> 2.5 inch); CSP = Change in structural period

5.9.2 Rut Depth

The data in Table 5.29 indicate that on average:

1. The thin and thick overlays using virgin AC mix extended the pavement structural period by about thirteen, eleven, seven, and nine years in the WF, WNF, DF, and DNF regions, respectively.
2. The thin and thick overlays using recycled AC mix in the WNF region extended the pavement structural period by seven and fourteen years, respectively.
3. The thin mill and fill treatment using virgin AC mix extended the pavement structural period by eleven, sixteen, and fourteen years in the WF, WNF, and DF regions, respectively. On the other hand, the thick mill and fill treatment using virgin AC mix extended the pavement structural period by thirteen, twenty, and nine years in the WF, WNF, and DNF regions, respectively.
4. The thick mill and fill treatment using recycled AC mix extended the pavement structural period by fifteen years in the WNF regions. Whereas, the thick mill and fill treatment using recycled AC mix caused a five-year loss in the pavement structural period in the WF region. This is most likely due to inadequate compaction during the construction of the AC fill.

5.9.3 Alligator Cracking

The data in Table 5.30 indicate that on average:

1. The thin virgin AC mix overlays extended the pavement structural period by about fourteen years in the WF and WNF regions. While, the thick overlay using virgin AC mix extended the pavement structural period by ten and six years in WNF and DNF regions, respectively.
2. In the WNF region, the thin and thick recycled AC mix overlays extended the pavement structural period by four and ten years, respectively.

3. The thin mill and fill treatment using virgin AC mix extended the pavement structural period by about six years in the WF and WNF regions and by eleven years in the DF region. Whereas, the thick mill and fill treatment using virgin AC mix extended the pavement structural period by four and fifteen years in the WNF and DNF regions, respectively.
4. The thick mill and fill treatment using recycled AC mix extended the pavement structural period by about thirteen years in the WF and WNF regions.

5.9.4 Longitudinal Cracking

The data in Table 5.31 indicate that on average:

1. The thin overlays using virgin AC mix extended the pavement structural period by about eight years in the WF and WNF regions. Likewise, the thick overlays using virgin AC mix extended the pavement structural period by eight years in the WNF region.
2. The thin and thick overlays using recycled AC mix extended the pavement structural period by about four years in the WNF region.
3. The thin mill and fill treatment using virgin AC mix extended the pavement structural period by five years in the WF and WNF regions and by eleven years in the DF region. Whereas, the thick mill and fill treatment using virgin AC mix extended the pavement structural period by fourteen and six years in the WNF and DNF regions, respectively.
4. The thick mill and fill treatment using recycled AC mix extended the pavement structural period by about fifteen years in the WF and WNF regions.

5.9.5 Transverse Cracking

The data in Table 5.32 indicate that on average:

1. The thin overlays using virgin AC mix extended the pavement structural period by about seven years in the WF and WNF regions. Whereas, the thick overlays using virgin AC mix

extended the pavement structural period by fourteen, eleven, and four years in the WF, WNF, and DNF regions, respectively.

2. The thin and thick overlays using recycled AC mix extended the pavement structural period by three years in the WNF region.
3. The thin mill and fill treatment using virgin AC mix extended the pavement structural period by five years in the WNF region. On the other hand, the thick mill and fill treatment using virgin AC mix extended the pavement structural period by about six years in the WNF and DNF regions.
4. The thin mill and fill treatment using recycled AC mix extended the pavement structural period by eleven years in the WNF region. The thick mill and fill treatment using recycled AC mix extended the pavement structural period by nine and thirteen years in the WF and WNF regions, respectively.

5.9.6 Impact of the Before Treatment Condition and Distress on the Performance of the Pavement after Treatments, GPS-6

Several attempts were made to analyze the impacts of the BT pavement condition (IRI) and distresses (rut depths and cracking) on the pavement performance after treatment. Examples of the results for thin and thick virgin AC overlay and for IRI and transverse cracking are shown in the treatment transition matrices (T^2Ms) in Tables 5.33 through 5.36. Although, only twenty-seven and sixteen test sections can be analyzed for thin and thick overlays using virgin AC mix; the results are logical and expected. The data in Tables 5.33 and 5.34 indicate that the before treatment pavement condition (IRI) has minute to no effects on the remaining functional period of the test sections. This is more pronounced for the thick AC overlay than for the thin AC overlay. That is if the AC overlay is constructed properly, it would produce a smooth pavement surface. Certainly thicker AC overlays will be constructed using two or more courses. The higher is the number of the overlay courses, the smoother is the final pavement surface. The implication herein is that, if a pavement section is to be treated based on high IRI (low ride quality), then the AC overlay should be constructed using at least two courses. Otherwise, the rough surface could be milled to even one and then subjected to a single course AC overlay.

Unfortunately, there are fewer number of test sections available for analyses of the structural period. Tables 5.35 and 5.36 for thin and thick virgin AC overlay, respectively, list the results of the analyses of the impacts of transverse cracking before treatment on the pavement performance relative to transverse cracking after treatment. It can be seen that there are only thirteen test sections for thin AC overlay and only five for the thick AC overlay. When these limited sections are distributed among the five condition states before treatment, the number of test sections in each CS becomes statistically insignificant to support reliable conclusions. Having stated that, the limited data indicate that the higher is the length of transverse cracks before treatment, the worse is the pavement performance after treatment. Further, the thick AC overlay performs better than the thin overlay; it retards reflective cracking better.

Table 5.33 Functional treatment transition matrix for thin overlay using virgin AC mix (IRI, number of LTPP test sections)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin overlay using virgin AC mix based on IRI											
	Before treatment (BT)				After treatment (AT) data							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition state (code and RFP ranges in years) and the number of LTPP test sections transferred from each BT condition state to the indicated AT condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		LTPP test sections		1	2	3	4	5	FCROP	CFP	RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	4	15	**0**	0	1	1	2	14	11	12
B	2	2 to < 4	2	7	0	**0**	0	0	2	20	13	16
C	3	4 to < 8	2	7	0	0	**0**	0	2	18	10	16
D	4	8 to < 13	15	56	0	0	0	**1**	14	10	6	16
E	5	≥ 13	4	15	0	0	0	0	**4**	9	0	16
F	Total		27	100	0	0	1	2	24	12	6	15

Table 5.34 Functional treatment transition matrix for thick overlay using virgin AC mix (IRI, number of LTPP test sections)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thick overlay using virgin AC mix based on IRI											
	Before treatment (BT)				After treatment (AT) data							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition state (code and RFP ranges in years) and the number of LTPP test sections transferred from each BT condition state to the indicated AT condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		LTPP test sections		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	4	25	**0**	0	0	0	4	20	15	16
B	2	2 to < 4	0	0	0	**0**	0	0	0			
C	3	4 to < 8	4	25	0	0	**0**	0	4	20	10	16
D	4	8 to < 13	5	31	0	0	0	**0**	5	10	6	16
E	5	≥ 13	3	19	0	0	0	0	**3**	18	0	16
F	Total		16	100	0	0	0	0	16	16	8	16

Table 5.35 Structural treatment transition matrix for thin overlay using virgin AC mix (TC, number of LTPP test sections)

Row designation	Column designation											
	A	B	C	D	F	G	H	I	J	K	L	M
	Remaining structural period (RSP) before and after thin overlay using virgin AC mix based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition state (code and RSP ranges in years) and the number of LTPP test sections transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		LTPP test sections		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	3	23	**1**	0	0	2	0	9	6	7
B	2	2 to < 4	2	15	0	**0**	0	0	2	12	13	16
C	3	4 to < 8	4	31	0	1	**0**	1	2	7	5	11
D	4	8 to < 13	3	23	0	0	1	**0**	2	6	3	13
E	5	≥ 13	1	8	0	0	0	1	**0**	6	-6	10
F	Total		13	100	1	1	1	4	6	8	5	11

Table 5.36 Structural treatment transition matrix for thick overlay using virgin AC mix (TC, number of LTPP test sections)

Row designation	Column designation											
	A	B	C	D	F	G	H	I	J	K	L	M
	Remaining structural period (RSP) before and after thick overlay using virgin AC mix based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition state (code and RSP ranges in years) and the number of LTPP test sections transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		LTPP test sections		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	3	60	**0**	0	0	1	2	13	13	14
B	2	2 to < 4	0	0	0	**0**	0	0	0			
C	3	4 to < 8	2	40	0	0	**0**	2	0	10	4	10
D	4	8 to < 13	0	0	0	0	0	**0**	0			
E	5	≥ 13	0	0	0	0	0	0	**0**			
F	Total		5	100	0	0	0	3	2	12	9	12

5.10 Summary, Conclusions, and Recommendations, GPS-6

The performance of pavement rehabilitation is a function of many variables including the type of rehabilitation, the material used, construction, traffic, and climate. Results of the analyses of the LTPP GPS-6 test sections confirm that. Although, the GPS-6 test sections do not represent full factorial for detailed analyses of each variable, there are several conclusions that can be cautiously made given the limited number of test sections. These conclusions include:

1. In each climatic region, the impacts of the thin and thick overlay or mill and fill treatment on IRI are almost the same. This was expected because good quality construction can decrease the pavement roughness substantially regardless of the overlay thickness.
2. Likewise, thin and thick overlays and mill and fill treatments have similar impact on rut depths. Once again, this was expected because most pavement rutting occurs early in the pavement life, which can be removed during the treatment. One word of caution is that poor compaction of the overlay may precipitate early rutting in the AC overlay.
3. The impact of the AC overlay and mill and fill treatments on pavement performance in terms of alligator and longitudinal cracking cannot be assessed with a certain degree of certainty due to the limited number of test sections.
4. The impact of thin and thick overlay on pavement performance in terms of transverse cracking is very much as expected; the thicker is the overlay or the mill and fill treatment, the more the reflective transverse cracking are retarded and the longer is the pavement structural period.
5. The effects of the climatic regions on the pavement condition and distress cannot be fully assessed because of the limited number of test sections in each climatic region.

Based on the results of the analyses, it is strongly recommended that:

1. The data collection frequency on newly designed and constructed or newly rehabilitated LTPP test sections be increased to a minimum of once a year, twice a year for test sections subjected to light rehabilitation, and three times a year for test section subjected to maintenance treatments.
2. The construction process be documented and the quality control data be included in the database.
3. Future analyses of pavement condition and distress data be based on the new pavement rating and classification systems; RFP and RSP.
4. The benefits of pavement rehabilitation and/or maintenance treatments be measured in terms of the RFP or RSP, CFP or CSP and FCROP or SCROP.

CHAPTER 6

DATA ANALYSES – RIGID PAVEMENTS

6.1 Background

Chapter 5 presented the results of the analyses of the time series condition and distress data of the LTPP flexible pavement test sections. This chapter presents the results of the analyses of the time series condition and distress data of the LTPP rigid pavement test sections.

6.2 Impacts of Climatic Region, Drainage, Slab Thickness, Concrete Flexural Strength, and Slab Width on Pavement Condition and Distress Using LTPP SPS-2 Test Sections

The main objective of the SPS-2 experiment is to study the effects of the climatic regions and the following structural factors on pavement performance (Jiang et al. 2005).

1. Slab thickness (8 and 11 inches)
2. The 14-day concrete flexural strength (3.8 MPa and 6.2 MPa)
3. Base type (dense-graded aggregate base, asphalt treated base, permeable asphalt treated base, and a combination thereof)
4. Presence or absence of a drainage layer
5. Slab widths (3.66 and 4.27 m)

The analyses of the impacts of the various design variables were accomplished using the following steps:

Step 1 - For each pavement test section in the LTPP SPS-2 experiment, the time dependent pavement condition (IRI) and distress (transverse and longitudinal cracking) data were downloaded from the LTPP database, organized, and analyzed. Results of the analyses included the RFP and RSP of each test section calculated as the time period from the time of construction to the time when the pavement condition or distress reach the appropriate threshold values. The reason for calculating the RFP and RSP from the construction data (surface age is zero) is that the dates of construction and the dates of the last data collection for the SPS-2 test sections are not the same. The implication of this is that the reference time for each SPS-2 test section is taken as the date of construction.

Step 2 - For each pavement condition and distress type, the resulting RFP and RSP values and other inventory data (such as SHRP ID, State, slab thickness, drainage, slab width, concrete flexural strength, and so forth) were then organized in an Excel spreadsheet format.

Step 3 – For each SHRP ID and for each pavement condition and distress type, the minimum and maximum RFP and RSP values and their averages were calculated and listed in the Excel spreadsheets.

Step 4 - The data were then organized into the various groups and subgroups listed below and in Table 6.1. The main objective of the division is to separate the design variables impacting pavement performance.

1. Climatic Region Groups – The results of the analyses were organized into the four climatic regions; wet-freeze (WF), wet-no-freeze (WNF), dry-freeze (DF), and dry-no-freeze (DNF).
2. Slab Thickness Subgroups – The results of the analyses in each climatic region were then organized into two subgroups based on the slab thicknesses of 8- and 11-inch.
3. Slab Width Subgroups - The results of the analyses in each slab thickness subgroup were then organized into two subgroups based on the slab widths of 3.66 and 4.27 m.

4. Concrete Flexural Strength Subgroups - The results in each slab width subgroup were then organized into two subgroups based on the concrete 14-day flexural strength of 3.8 MPa and 6.2 MPa.
5. Drainage Subgroups – The results in each concrete flexural strength subgroup were further divided into two drainage subgroups (presence and absence of drainage).

Further grouping based on the aggregate base type and traffic would yield an insignificant number of test sections per each subgrouping. Hence, the impacts of the aggregate base types were studied based on the presence or absence of drainage only and the impact of traffic was not addressed. Nevertheless, the number of test sections available for analyses in each subgroup is listed in Table 6.1. The impacts of climatic region, slab thickness and width, flexural strength, and drainable and undrainable bases on the pavement performance in terms of RFP and RSP were analyzed.

The detailed analysis results are listed in Tables E.1 through E.12 of Appendix E. For convenience, the detailed results were summarized and are listed in Tables 6.2 through 6.13. Since there are many design variables, four tables were populated to summarize the impacts of the design variables on RFP or RSP for each pavement condition or distress. Each table summarizes the impacts of climatic region, slab thickness, drainable bases, and a combination of slab width and concrete flexural strength on the RFP or RSP of test sections based on one condition (IRI) or one distress (longitudinal or transverse cracks). For example, Table 6.2 provides a summary of the results of the analyses of the impacts of design factors on the RFP based on the IRI of LTPP SPS-2 test sections having slab width of 3.66 m. and concrete flexural strength of 3.8 MPa.

Table 6.1 Analysis subgroups and the number of test sections available for analyses in the SPS-2 experiment in each subgroup

<table>
<tr><th rowspan="3">Condition/ distress type</th><th rowspan="3">Lane width (m)</th><th rowspan="3">Slab strength (MPa)</th><th rowspan="3">Slab thickness (in)</th><th colspan="8">Number of available test sections based on climatic region and presence of aggregate base drainage</th></tr>
<tr><th colspan="2">WF</th><th colspan="2">WNF</th><th colspan="2">DF</th><th colspan="2">DNF</th></tr>
<tr><th>D</th><th>ND</th><th>D</th><th>ND</th><th>D</th><th>ND</th><th>D</th><th>ND</th></tr>
<tr><td rowspan="8">IRI</td><td rowspan="4">3.66</td><td rowspan="2">3.8</td><td>8</td><td>1</td><td>4</td><td>1</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>3</td><td>8</td><td>1</td><td>2</td><td>3</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>3</td><td>7</td><td>1</td><td>2</td><td>3</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td>11</td><td>1</td><td>3</td><td>2</td><td>3</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="4">4.27</td><td rowspan="2">3.8</td><td>8</td><td>3</td><td>6</td><td>1</td><td>2</td><td>3</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>1</td><td>4</td><td>1</td><td>4</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>2</td><td>4</td><td>0</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>2</td><td>7</td><td>0</td><td>2</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="8">LC</td><td rowspan="4">3.66</td><td rowspan="2">3.8</td><td>8</td><td>2</td><td>3</td><td>1</td><td>4</td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>4</td><td>8</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>4</td><td>8</td><td>1</td><td>2</td><td>0</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>2</td><td>3</td><td>2</td><td>4</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="4">4.27</td><td rowspan="2">3.8</td><td>8</td><td>4</td><td>7</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>2</td><td>4</td><td>2</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>2</td><td>4</td><td>0</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>4</td><td>7</td><td>0</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="8">TC</td><td rowspan="4">3.66</td><td rowspan="2">3.8</td><td>8</td><td>2</td><td>3</td><td>1</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>4</td><td>8</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>4</td><td>8</td><td>1</td><td>2</td><td>0</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>2</td><td>3</td><td>2</td><td>4</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="4">4.27</td><td rowspan="2">3.8</td><td>8</td><td>4</td><td>7</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>2</td><td>4</td><td>2</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">6.2</td><td>8</td><td>2</td><td>4</td><td>0</td><td>4</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>11</td><td>4</td><td>7</td><td>0</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td colspan="12">IRI = international roughness index; TC = transverse cracking; LC = longitudinal cracking, D = drainable base; ND = undrainable base; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze</td></tr>
</table>

While Table 6.3 provides a summary of the results of analyses of the impacts of design factors on RFP based on the IRI of LTPP SPS-2 test sections having slab width of 4.27 m and concrete flexural strength of 3.8 MPa. The numbers in the tables indicate the differences in years in the RFP or RSP values of the SPS-2 test sections having the top heading parameters relative to the RFP and RSP values of the SPS-2 test sections having the side heading parameters. For convenience, the listed numbers in Tables 6.2 through 6.13 are explained below using the data from the first and second rows in Table 6.2.

1. In the WF region, the RFP of the LTPP SPS-2 test sections having 11-inch thick slab and non-drainable bases is:
   - Two years less than the RFP of test sections located in the WF region and having 8-inch thick slab and drainable bases.
   - An insignificant one year less than the RFP of test sections located in the WF region and having 8-inch thick slab and none drainable bases.
2. In the DNF region, the RFP of the LTPP SPS-2 test sections having 8-inch thick slab and none drainable bases is three years less than the RFP of test sections located in the WF region and having 8-inch thick slab and either drainable or none drainable bases.
3. It should be noted that the results are listed in Tables 6.2 to 6.13 and conclusions cannot be made. Therefore, the data in Tables 6.2 through 6.13 were further summarized in Table 6.14 based on the relative performance of comparable SPS-2 test sections. In this context, the term "comparable" implies SPS-2 test sections having the same slab thickness and slab width, the same concrete flexural strength, and similar bases. The summarized data in Table 6.14. The data in the table address the impact of the climatic regions on pavement performance in terms of functional condition (RFP based on IRI) and structural condition (RSP based on

longitudinal and transverse cracking). The values in the table indicate the percent of the test sections, having the heading parameters, which performed either better, the same, or worse relative to the test sections having the side heading parameters. These values are presented and discussed below for each pavement condition and distress type.

6.2.1 International Roughness Index (IRI)

The data listed in the IRI block in Table 6.14 indicate that the pavement performance based on IRI, of the majority of the SPS-2 test sections, is not impacted by the climatic regions. The various findings leading to the above conclusion are detailed below.

- In the WF region, seventy, sixty-eight, and sixty-five percent of the SPS-2 test sections performed the same as comparable test sections located in the WNF, DF, and DNF regions, respectively. While twenty-six, thirty-two, and twenty-six percent performed worse.
- In the WNF region, ninety and eighty-two percent of the SPS-2 test sections performed the same as comparable test sections located in the DF and DNF regions, respectively. While only ten and nine percent performed worse.
- In the DF region, ninety percent of the SPS-2 test section performed the same as comparable test sections located in the DNF region and only ten percent performed better.

Table 6.2 Summary of the results of the analyses of the impacts of design factors on RFP based on IRI of LTPP SPS-2 test sections with slab width of 3.66 m and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8”	D		0	0	-2	0	0	0	0	0	0	0	0	0	-3	0	0
		ND	0		0	-1	0	0	0	0	0	0	0	0	0	-3	0	0
	11”	D	0	0		-2	0	0	0	0	0	0	0	0	0	-3	0	0
		ND	2	1	2		2	2	2	2	2	2	2	2	2	-2	2	2
WNF	8”	D	0	0	0	-2		0	0	0	0	0	0	0	0	-3	0	0
		ND	0	0	0	-2	0		0	0	0	0	0	0	0	-3	0	0
	11”	D	0	0	0	-2	0	0		0	0	0	0	0	0	-3	0	0
		ND	0	0	0	-2	0	0	0		0	0	0	0	0	-3	0	0
DF	8”	D	0	0	0	-2	0	0	0	0		0	0	0	0	-3	0	0
		ND	0	0	0	2	0	0	0	0	0		0	0	0	-3	0	0
	11”	D	0	0	0	-2	0	0	0	0	0	0		0	0	-3	0	0
		ND	0	0	0	-2	0	0	0	0	0	0	0		0	-3	0	0
DNF	8”	D	0	0	0	-2	0	0	0	0	0	0	0	0		-3	0	0
		ND	3	3	3	2	3	3	3	3	3	3	3	3	3		3	3
	11”	D	0	0	0	-2	0	0	0	0	0	0	0	0	0	-3		0
		ND	0	0	0	-2	0	0	0	0	0	0	0	0	0	-3	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.3 Summary of the results of analyses of the impacts of design factors on RFP based on IRI of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-4	0	0	0	-1	0	0	0	0	0	0	0	0	0	-2
		ND	4		4	4	4	3	4	4	4	4	4	4	4	4	4	2
	11	D	0	-4		0	0	-1	0	0	0	0	0	0	0	0	0	-2
		ND	0	-4	0		0	-1	0	0	0	0	0	0	0	0	0	-2
WNF	8	D	0	-4	0	0		-1	0	0	0	0	0	0	0	0	0	-2
		ND	1	-3	1	1	1		1	1	1	1	1	1	1	1	1	-1
	11	D	0	-4	0	0	0	-1		0	0	0	0	0	0	0	0	-2
		ND	0	-4	0	0	0	-1	0		0	0	0	0	0	0	0	-2
DF	8	D	0	-4	0	0	0	-1	0	0		0	0	0	0	0	0	-2
		ND	0	-4	0	0	0	-1	0	0	0		0	0	0	0	0	-2
	11	D	0	-4	0	0	0	-1	0	0	0	0		0	0	0	0	-2
		ND	0	-4	0	2	0	-1	0	0	0	0	0		0	0	0	-2
DNF	8	D	0	-4	0	0	0	-1	0	0	0	0	0	0		0	0	-2
		ND	0	-4	0	0	0	-1	0	0	0	0	0	0	0		0	-2
	11	D	0	-4	0	0	0	-1	0	0	0	0	0	0	0	0		-2
		ND	2	-2	2	2	2	1	2	2	2	2	2	2	2	2	2	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.4 Summary of the results of analyses of the impacts of design factors on RFP based on IRI of LTPP SPS-2 test sections with slab width 3.66 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-4	0	0	0	-2	0	0	NC	0	NC	0	0	0	0	0
		ND	4		4	4	4	2	4	4	NC	4	NC	4	4	4	4	4
	11	D	0	-4		0	0	-2	0	0	NC	0	NC	0	0	0	0	0
		ND	0	-4	0		0	-2	0	0	NC	0	NC	0	0	0	0	0
WNF	8	D	0	-4	0	0		-2	0	0	NC	0	NC	0	0	0	0	0
		ND	2	-2	2	2	2		2	2	NC	2	NC	2	2	2	2	2
	11	D	0	-4	0	0	0	-2		0	NC	0	NC	0	0	0	0	0
		ND	0	-4	0	0	0	-2	0		NC	0	NC	0	0	0	0	0
DF	8	D	NC	NC	NC	0	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC
		ND	0	-4	0	0	0	-2	0	0	NC		NC	0	0	0	0	0
	11	D	NC	NC	NC	0	NC	NC	NC	NC	NC	NC		NC	NC	NC	NC	NC
		ND	0	-4	0	0	0	-2	0	0	NC	0	NC		0	0	0	0
DNF	8	D	0	-4	0	0	0	-2	0	0	NC	0	NC	0		0	0	0
		ND	0	-4	0	0	0	-2	0	0	NC	0	NC	0	0		0	0
	11	D	0	-4	0	0	0	-2	0	0	NC	0	NC	0	0	0		0
		ND	0	-4	0	0	0	-2	0	0	NC	0	NC	0	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.5 Summary of the results of analyses of the impacts of design factors on RFP based on IRI of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		0	0	0	NC	0	NC	0	0	0	NC	0	0	0	0	0
		ND	0		0	0	NC	0	NC	0	0	0	NC	0	0	0	0	0
	11	D	0	0		0	NC	0	NC	0	0	0	NC	0	0	0	0	0
		ND	0	0	0		NC	0	NC	0	0	0	NC	0	0	0	0	0
WNF	8	D	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	0	0	0	0	NC		NC	0	0	0	NC	0	0	0	0	0
	11	D	NC	NC	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	0	0	0	0	NC	0	NC		0	0	NC	0	0	0	0	0
DF	8	D	0	0	0	0	NC	0	NC	0		0	NC	0	0	0	0	0
		ND	0	0	0	0	NC	0	NC	0	0		NC	0	0	0	0	0
	11	D	NC	NC	NC	0	NC	NC	NC	NC	NC	NC		NC	NC	NC	NC	NC
		ND	0	0	0	0	NC	0	NC	0	0	0	NC		0	0	0	0
DNF	8	D	0	0	0	0	NC	0	NC	0	0	0	NC	0		0	0	0
		ND	0	0	0	0	NC	0	NC	0	0	0	NC	0	0		0	0
	11	D	0	0	0	0	NC	0	NC	0	0	0	NC	0	0	0		0
		ND	0	0	0	0	NC	0	NC	0	0	0	NC	0	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.6 Summary of the results of analyses of the impacts of design factors on RSP based on longitudinal cracking of LTPP SPS-2 test sections with slab width 3.66 meters and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick . (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8" PCC		11" PCC		8" PCC		11" PCC		8" PCC		11" PCC		8" PCC		11" PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-2	0	0	0	-1	0	0	0	-3	0	0	0	-7	0	0
		ND	2		2	2	2	1	2	2	2	-1	2	2	2	-5	2	2
	11	D	0	-2		0	0	-1	0	0	0	-3	0	0	0	-7	0	0
		ND	0	-2	0		0	-1	0	0	0	-3	0	0	0	-7	0	0
WNF	8	D	0	-2	0	0		-1	0	0	0	-3	0	0	0	-7	0	0
		ND	1	-1	1	1	1		1	1	0	-2	1	1	1	-6	1	1
	11	D	0	-2	0	0	0	-1		0	0	-3	0	0	0	-7	0	0
		ND	0	-2	0	0	0	-1	0		0	-3	0	0	0	-7	0	0
DF	8	D	0	-2	0	0	0	0	0	0		-3	0	0	0	-6	0	0
		ND	3	1	3	7	3	2	3	3	3		3	3	3	-4	3	3
	11	D	0	-2	0	0	0	-1	0	0	0	-3		0	0	-7	0	0
		ND	0	-2	0	0	0	-1	0	0	0	-3	0		0	-7	0	0
DNF	8	D	0	-2	0	0	0	-1	0	0	0	-3	0	0		-7	0	0
		ND	7	5	7	7	7	6	7	7	6	4	7	7	7		7	7
	11	D	0	-2	0	0	0	-1	0	0	0	-3	0	0	0	-7		0
		ND	0	-2	0	0	0	-1	0	0	0	-3	0	0	0	-7	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.7 Summary of the results of analyses of the impacts of design factors on RSP based on longitudinal cracking of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-3	0	0	0	-7	0	0	0	0	0	-3	0	0	0	0
		ND	3		3	3	3	-4	3	3	3	3	3	1	3	3	3	3
	11	D	0	-3		0	0	-7	0	0	0	0	0	-3	0	0	0	0
		ND	0	-3	0		0	-7	0	0	0	0	0	-3	0	0	0	0
WNF	8	D	0	-3	0	0		-7	0	0	0	0	0	-3	0	0	0	0
		ND	7	4	7	7	7		7	7	7	7	7	5	7	7	7	7
	11	D	0	-3	0	0	0	-7		0	0	0	0	-3	0	0	0	0
		ND	0	-3	0	0	0	-7	0		0	0	0	-3	0	0	0	0
DF	8	D	0	-3	0	0	0	-7	0	0		0	0	-3	0	0	0	0
		ND	0	-3	0	0	0	-7	0	0	0		0	-3	0	0	0	0
	11	D	0	-3	0	0	0	-7	0	0	0	0		-3	0	0	0	0
		ND	3	-1	3	0	3	-5	3	3	3	3	3		3	3	3	3
DNF	8	D	0	-3	0	0	0	-7	0	0	0	0	0	-3		0	0	0
		ND	0	-3	0	0	0	-7	0	0	0	0	0	-3	0		0	0
	11	D	0	-3	0	0	0	-7	0	0	0	0	0	-3	0	0		0
		ND	0	-3	0	0	0	-7	0	0	0	0	0	-3	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.8 Summary of the results of analyses of the impacts of design factors on RSP based on longitudinal cracking of LTPP SPS-2 test sections with slab width 3.66 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-2	0	-2	0	-3	0	0	NC	0	0	0	0	0	0	0
		ND	2		2	-1	2	-1	2	2	NC	2	2	2	2	2	2	2
	11	D	0	-2		-2	0	-3	0	0	NC	0	0	0	0	0	0	0
		ND	2	1	2		2	-1	2	2	NC	2	2	2	2	2	2	2
WNF	8	D	0	-2	0	-2		-3	0	0	NC	0	0	0	0	0	0	0
		ND	3	1	3	1	3		3	3	NC	3	3	3	3	3	3	3
	11	D	0	-2	0	-2	0	-3		0	NC	0	0	0	0	0	0	0
		ND	0	-2	0	-2	0	-3	0		NC	0	0	0	0	0	0	0
DF	8	D	NC	NC	NC	-2	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC
		ND	0	-2	0	-2	0	-3	0	0	NC		0	0	0	0	0	0
	11	D	0	-2	0	-2	0	-3	0	0	NC	0		0	0	0	0	0
		ND	0	-2	0	-2	0	-3	0	0	NC	0	0		0	0	0	0
DNF	8	D	0	-2	0	-2	0	-3	0	0	NC	0	0	0		0	0	0
		ND	0	-2	0	-2	0	-3	0	0	NC	0	0	0	0		0	0
	11	D	0	-2	0	-2	0	-3	0	0	NC	0	0	0	0	0		0
		ND	0	-2	0	-2	0	-3	0	0	NC	0	0	0	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.9 Summary of the results of analyses of the impacts of design factors on RSP based on longitudinal cracking of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		0	0	0	NC	0	NC	0	-1	0	0	-3	0	0	0	0
		ND	0		0	0	NC	0	NC	0	-1	0	0	-3	0	0	0	0
	11	D	0	0		0	NC	0	NC	0	-1	0	0	-3	0	0	0	0
		ND	0	0	0		NC	0	NC	0	-1	0	0	-3	0	0	0	0
WNF	8	D	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	0	0	0	0	NC		NC	0	-1	0	0	-3	0	0	0	0
	11	D	NC	NC	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	0	0	0	0	NC	0	NC		-1	0	0	-3	0	0	0	0
DF	8	D	1	1	1	0	NC	1	NC	1		1	1	-2	1	1	1	1
		ND	0	0	0	0	NC	0	NC	0	-1		0	-3	0	0	0	0
	11	D	0	0	0	0	NC	0	NC	0	-1	0		-3	0	0	0	0
		ND	3	3	3	0	NC	3	NC	3	2	3	3		3	3	3	3
DNF	8	D	0	0	0	0	NC	0	NC	0	-1	0	0	-3		0	0	0
		ND	0	0	0	0	NC	0	NC	0	-1	0	0	-3	0		0	0
	11	D	0	0	0	0	NC	0	NC	0	-1	0	0	-3	0	0		0
		ND	0	0	0	0	NC	0	NC	0	-1	0	0	-3	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.10 Summary of the results of analyses of the impacts of design factors on RSP based on transverse cracking of LTPP SPS-2 test sections with slab width 3.66 meters and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8" PCC		11" PCC		8" PCC		11" PCC		8" PCC		11" PCC		8" PCC		11" PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-6	1	-1	1	-4	1	1	1	1	1	1	1	-12	1	1
		ND	6		6	5	6	2	6	6	6	6	6	6	6	-6	6	6
	11	D	-1	-6		-2	0	-4	0	0	0	0	0	0	0	-12	0	0
		ND	1	-5	2		2	-3	2	2	2	2	2	2	2	-11	2	2
WNF	8	D	-1	-6	0	-2		-4	0	0	0	0	0	0	0	-12	0	0
		ND	4	-2	4	3	4		4	4	4	4	4	4	4	-8	4	4
	11	D	-1	-6	0	-2	0	-4		0	0	0	0	0	0	-12	0	0
		ND	-1	-6	0	-2	0	-4	0		0	0	0	0	0	-12	0	0
DF	8	D	-1	-6	0	-2	0	-4	0	0		0	0	0	0	-12	0	0
		ND	-1	-6	0	11	0	-4	0	0	0		0	0	0	-12	0	0
	11	D	-1	-6	0	-2	0	-4	0	0	0	0		0	0	-12	0	0
		ND	-1	-6	0	-2	0	-4	0	0	0	0	0		0	-12	0	0
DNF	8	D	-1	-6	0	-2	0	-4	0	0	0	0	0	0		-12	0	0
		ND	12	6	12	11	12	8	12	12	12	12	12	12	12		12	12
	11	D	-1	-6	0	-2	0	-4	0	0	0	0	0	0	0	-12		0
		ND	-1	-6	0	-2	0	-4	0	0	0	0	0	0	0	-12	0	
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared																		

Table 6.11 Summary of the results of analyses of the impacts of design factors on RSP based on transverse cracking of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 3.8 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-2	0	0	0	-5	0	0	0	0	0	0	0	-1	0	-1
		ND	2		2	2	2	-3	2	2	2	2	2	2	2	0	2	0
	11	D	0	-2		0	0	-5	0	0	0	0	0	0	0	-1	0	-1
		ND	0	-2	0		0	-5	0	0	0	0	0	0	0	-1	0	-1
WNF	8	D	0	-2	0	0		-5	0	0	0	0	0	0	0	-1	0	-1
		ND	5	3	5	5	5		5	5	5	5	5	5	5	3	5	3
	11	D	0	-2	0	0	0	-5		0	0	0	0	0	0	-1	0	-1
		ND	0	-2	0	0	0	-5	0		0	0	0	0	0	-1	0	-1
DF	8	D	0	-2	0	0	0	-5	0	0		0	0	0	0	-1	0	-1
		ND	0	-2	0	1	0	-5	0	0	0		0	0	0	-1	0	-1
	11	D	0	-2	0	0	0	-5	0	0	0	0		0	0	-1	0	-1
		ND	0	-2	0	1	0	-5	0	0	0	0	0		0	-1	0	-1
DNF	8	D	0	-2	0	0	0	-5	0	0	0	0	0	0		-1	0	-1
		ND	1	0	1	1	1	-3	1	1	1	1	1	1	1		1	0
	11	D	0	-2	0	0	0	-5	0	0	0	0	0	0	0	-1		-1
		ND	1	0	1	1	1	-3	1	1	1	1	1	1	1	0	1	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.12 Summary of the results of analyses of the impacts of design factors on RSP based on transverse cracking of LTPP SPS-2 test sections with slab width 3.66 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-1	-2	-5	1	-5	1	1	NC	1	1	1	1	1	1	1
		ND	1		0	-3	2	-4	2	2	NC	2	2	2	2	2	2	2
	11	D	2	0		-3	3	-4	3	3	NC	3	3	3	3	3	3	3
		ND	5	3	3		6	-1	6	6	NC	6	6	6	6	6	6	6
WNF	8	D	-1	-2	-3	-6		-6	0	0	NC	0	0	0	0	0	0	0
		ND	5	4	4	1	6		6	6	NC	6	6	6	6	6	6	6
	11	D	-1	-2	-3	-6	0	-6		0	NC	0	0	0	0	0	0	0
		ND	-1	-2	-3	-6	0	-6	0		NC	0	0	0	0	0	0	0
DF	8	D	NC	NC	NC	-6	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC
		ND	-1	-2	-3	-6	0	-6	0	0	NC		0	0	0	0	0	0
	11	D	-1	-2	-3	-6	0	-6	0	0	NC	0		0	0	0	0	0
		ND	-1	-2	-3	-6	0	-6	0	0	NC	0	0		0	0	0	0
DNF	8	D	-1	-2	-3	-6	0	-6	0	0	NC	0	0	0		0	0	0
		ND	-1	-2	-3	-6	0	-6	0	0	NC	0	0	0	0		0	0
	11	D	-1	-2	-3	-6	0	-6	0	0	NC	0	0	0	0	0		0
		ND	-1	-2	-3	-6	0	-6	0	0	NC	0	0	0	0	0	0	

WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared

Table 6.13 Summary of the results of analyses of the impacts of design factors on RSP based on transverse cracking of LTPP SPS-2 test sections with slab width 4.27 meters and concrete flexural strength of 6.2 MPa

C.R	PCC Slab thick. (in)	Base type	Differences between the RFP of the top heading and the RFP of the side heading (year)															
			WF				WNF				DF				DNF			
			8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC		8” PCC		11” PCC	
			D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND	D	ND
WF	8	D		-2	2	2	NC	2	NC	2	-5	2	2	0	2	-3	2	2
		ND	2		4	4	NC	4	NC	4	-3	4	4	2	4	-1	4	4
	11	D	-2	-4		0	NC	0	NC	0	-7	0	0	-2	0	-5	0	0
		ND	-2	-4	0		NC	0	NC	0	-7	0	0	-2	0	-5	0	0
WNF	8	D	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	-2	-4	0	0	NC		NC	0	-7	0	0	-2	0	-5	0	0
	11	D	NC	NC	NC	NC	NC	NC		NC	NC	NC	NC	NC	NC	NC	NC	NC
		ND	-2	-4	0	0	NC	0	NC		-7	0	0	-2	0	-5	0	0
DF	8	D	5	3	7	0	NC	7	NC	7		7	7	5	7	2	7	7
		ND	-2	-4	0	5	NC	0	NC	0	-7		0	-2	0	-5	0	0
	11	D	-2	-4	0	0	NC	0	NC	0	-7	0		-2	0	-5	0	0
		ND	0	-2	2	0	NC	2	NC	2	-5	2	2		2	-3	2	2
DNF	8	D	-2	-4	0	0	NC	0	NC	0	-7	0	0	-2		-5	0	0
		ND	3	1	5	5	NC	5	NC	5	-2	5	5	3	5		5	5
	11	D	-2	-4	0	0	NC	0	NC	0	-7	0	0	-2	0	-5		0
		ND	-2	-4	0	0	NC	0	NC	0	-7	0	0	-2	0	-5	0	
WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; D = drainable base; ND = non-drainable base; PCC= Portland cement concrete; NC = could not be compared																		

Table 6.14 Summary of the results of the analyses of the effects of climatic region on the performance of the LTPP SPS-2 test sections

Condition / distress type	Climatic regions	Climatic regions											
		WF			WNF			DF			DNF		
		Better	Same	Worse	Better	Same	Worse	Better	Same	Worse	Better	Same	Worse
IRI	WF				26	70	4	32	68	0	26	65	9
	WNF	4	70	26				10	90	0	9	82	9
	DF	0	68	32	0	90	10				0	90	10
	DNF	9	65	26	9	82	9	10	90	0			
LC	WF				13	78	9	14	68	18	17	79	4
	WNF	9	78	13				14	72	14	78	18	4
	DF	18	68	14	14	72	14				18	77	5
	DNF	4	79	17	4	18	78	5	77	18			
TC	WF				39	44	17	48	43	9	39	35	26
	WNF	17	44	39				18	77	5	13	64	23
	DF	9	43	48	5	77	18				9	64	27
	DNF	26	35	39	23	64	13	27	64	9			

IRI = International Roughness Index; LC = longitudinal cracking; TC = transverse cracking; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze

6.2.2 Longitudinal Cracking

The data listed in the longitudinal cracking block in Table 6.14 indicate that:

1. In the WF region, seventy-eight, sixty-eight, and seventy-nine percent of the SPS-2 test sections performed the same as comparable test sections located in the WNF, DF, and DNF regions, respectively. While thirteen, fourteen, and seventeen percent performed worse and nine, eighteen, and four percent performed better.
2. In the WNF region, seventy-two and eighteen percent of the SPS-2 test sections performed the same as comparable test sections located in the DF and DNF regions, respectively. While fourteen and seventy-eight percent performed worse and fourteen and four percent performed better.
3. In the DF region, seventy-seven percent of the SPS-2 test section performed the same as comparable test sections located in the DNF region and eighteen percent performed worse.

6.2.3 Transverse Cracking

The data listed in the transverse cracking block in Table 6.14 indicate that:

1. In the WF region, forty-four, forty-three, and thirty-five percent of the SPS-2 test sections performed the same as comparable test sections located in the WNF, DF, and DNF regions, respectively. While seventeen, nine, and twenty-six percent performed better and thirty-nine, forty-eight, and thirty-nine percent performed worse.
2. In the WNF region, the majority (seventy-seven and sixty-four percent) of the SPS-2 test sections performed the same as comparable test sections located in the DF and DNF regions, respectively. While few percentages performed either better or worse.

3. Likewise, in the DF region, the majority of the SPS-2 test sections performed the same as comparable test sections located in the DNF region. While twenty-seven percent performed better and nine percent performed worse.

6.3 Summary, Conclusions, and Recommendations, SPS-2

The available data in the LTPP database standard release 28 regarding the LTPP SPS-2 experiment were downloaded, organized, and analyzed. When the data were divided into various groups based on separation of variables, the number of test sections under each variable was statistically insignificant. However, for each test section, the resulting RFP and RSP values are listed in Tables 6.2 through 6.13. Because of the limited number of SPS-2 test sections under each variable, the impact of the design variables on pavement performance were not analyzed or discussed any further. Rather, the data were summarized in Table 6.14 and the impacts of the climatic region on pavement performance was presented in the previous section. Based on the analyses results, the following conclusions were drawn:

1. On average, the pavement performance relative to IRI is not affected by the climatic region. Although, the data slightly indicate that SPS-2 test sections located in the WF region performed slightly worse than compatible test sections located in the other three climatic regions.
2. On average, the majority of the SPS-2 test sections located in the WNF region performed worse relative to longitudinal cracking than those in the DNF region. This is mainly due to the impact of excessive moisture on pavement performance.
3. The WF region has more damaging impact on pavement performance relative to transverse cracking than the WNF, DF, and DNF regions. This was expected due to the combined effects of subfreezing temperatures and moisture.

6.4 Impacts of Maintenance Treatments on Pavement Condition and Distress Using the LTPP SPS-4 Test Sections

The main objective of the LTPP SPS-4 experiment is to compare the performance of rigid pavement test sections subjected to selected maintenance treatments to the performance of untreated test sections or the control sections. The thirty-four SPS-4 test sites were initiated between 1990 and 1995 and are distributed across the USA and Canada. Each of the SPS-4 test sites consists of three test sections, two were subjected to one of the treatments listed below and the other is counted as a control section that was not treated as per the original experimental design.

1. Joint and crack sealing (410)
2. Joint undersealing (420)

However, only 10 of the 34 test sites contain a test section that was joint undersealed, bringing the total number of test sections and control sections to 78. There are several variables that affect the performance of the treated pavement sections. These include climatic region, traffic, subgrade type, etc. Similar to the SPS-3 experiment, unfortunately, if these variables were separated, in some scenarios, the number of test sections available for analyses becomes insignificant. To illustrate, Table 6.15 provides a list of the number of test sections available for analyses based on the separation of the following variables:

- Two treatment types
- One pavement condition (IRI)
- Two pavement distress types (longitudinal and transverse cracking)
- Four climatic regions; WF, WNF, DF, and DNF
- Three traffic levels

It can be seen that, for longitudinal and transverse cracking, the number of SPS-4 test sections that are available for analyses is statistically insignificant in each climatic region.

Therefore, the analyses were conducted to assess the impact of each treatment type in each climatic region and for each pavement condition and distress type. That is, the data were not separated based on traffic level or by the type of subbase or subgrade. Nevertheless, the analyses of the impacts of each of the two treatment types on pavement performance were accomplished using the following steps:

Step 1 - For each treated pavement test section in the SPS-4 experiment, each of the available pavement condition (IRI) and distress data were used to calculate the RFP and RSP of that section from the time of the treatment to the time when the pavement condition or distress reach the pre-specified threshold values.

Step 2 – For each pavement condition and distress type and for each pavement treatment type, the minimum and maximum RFP and RSP values and their averages for all test sections located in the same climatic region were calculated and are listed in Tables 6.16 through 6.18 depending on the pavement condition and distress type.

The results of the analyses are discussed per pavement condition and distress type in the next three subsections.

6.4.1 International Roughness Index (IRI)

The calculated minimum, maximum, and average RFP values based on IRI data for the SPS-4 test sections that were subjected to the same treatment type and for the associated control sections are listed in Table 6.16. The data in the table indicate that:

1. There are eight SPS-4 test sections in the WF region that were subjected to joint and crack sealing and accepted for analyses. The minimum, maximum, and average RFP values of the

Table 6.15 Number of test sections that have AT pavement condition and distress and traffic data

Condition or distress type	Treatment type	Number of test sections subjected to each of three traffic levels in the various climatic regions											
		Wet-freeze			Wet-no-freeze			Dry-freeze			Dry-no-freeze		
		L	M	H	L	M	H	L	M	H	L	M	H
IRI	Joint and crack sealing	0	0	7	1	3	6	0	0	2	0	0	2
	Joint undersealing	0	0	0	0	3	3	0	0	1	0	0	1
	Control section	0	0	7	1	3	7	0	0	1	0	0	2
Longitudinal cracking	Joint and crack sealing	0	0	0	0	2	3	0	0	0	0	0	0
	Joint undersealing	0	0	0	0	1	1	0	0	0	0	0	0
	Control section	0	0	1	0	2	0	0	0	1	0	0	2
Transverse cracking	Joint and crack sealing	0	0	1	0	1	3	0	0	1	0	0	0
	Joint undersealing	0	0	0	0	0	2	0	0	0	0	0	0
	Control section	0	0	2	0	1	2	0	0	1	0	0	1
L = low traffic (0 to 60,000 ESAL/yr); M = medium traffic (61,000 to 120,000 ESAL/yr); H = high traffic (>120,000 ESAL/yr)													
For each pavement condition and distress type, a test section is analyzed only if it exhibits any condition or distress and has three or more data points after treatment that can be modeled.													

eight SPS-4 test sections are ten, twenty, and seventeen years, respectively. In addition, there are eight control sections with minimum, maximum, and average RFP values of eight,

2. twenty, and seventeen respectively. Thus, the difference between the average RFP of the treated and control test sections is zero. That is, joint crack sealing has no impact on pavement performance in the WF region.
3. The average RFP value of the ten treated SPS-4 test sections located in the WNF region is three years higher than the average RFP value of the eleven control sections located in the same region.
4. The average RFP value of the four treated SPS-4 test sections located in the DF region is three years less than the average RFP value of the two control sections located in the same region.

Table 6.16 Impacts of various maintenance treatments and control section on pavement performance in terms of RFP based on IRI

C.R.	Treatment type	Remaining functional period (year)								Difference in RFP (year)
		Test sections				Control sections				
		Number of test sections	Min	Max	Avg	Number of test sections	Min	Max	Avg	
WF	JCS	8	10	20	17	8	8	20	17	0
WNF		10	6	20	18	11	0	20	15	3
DF		4	1	16	9	2	11	13	12	-3
DNF		2	5	20	12	2	17	17	17	-4
WF	JUS	0	-	-	-	8	8	20	17	NC
WNF		6	0	20	12	11	0	20	15	-3
DF		1	3	3	3	2	11	13	12	-10
DNF		1	2	2	2	2	17	17	17	-14
JCS = joint crack sealing; JUS = joint undersealing; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

Table 6.17 Impacts of various maintenance treatments on pavement performance in terms of RSP based on LC

C.R.	Treatment type	Remaining structural period (year)								Differences in RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Avg	Number of sections	Min	Max	Avg	
WF	JCS	0	-	-	-	1	20	20	20	NC
WNF		5	13	20	19	2	20	20	20	-1
DF		0	-	-	-	1	20	20	20	NC
DNF		0	-	-	-	2	17	20	19	NC
WF	JUS	0	-	-	-	1	20	20	20	NC
WNF		2	20	20	20	2	20	20	20	0
DF		0	-	-	-	1	20	20	20	NC
DNF		0	-	-	-	2	17	20	19	NC
JCS = joint crack sealing; JUS = joint undersealing; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

Table 6.18 Impacts of various maintenance treatments on pavement performance in terms of RSP based on TC

C.R.	Treatment type	Remaining structural period (year)								Differences in RSP (year)
		Test sections				Control sections				
		Number of sections	Min	Max	Avg	Number of sections	Min	Max	Avg	
WF	JCS	1	20	20	20	2	11	20	16	4
WNF		4	6	20	14	3	20	20	20	-6
DF		1	19	19	19	1	20	20	20	-1
DNF		0	-	-	-	1	14	14	14	NC
WF	JUS	0	-	-	-	2	11	20	16	NC
WNF		2	1	20	11	3	20	20	20	-9
DF		0	-	-	-	1	20	20	20	NC
DNF		0	-	-	-	1	14	14	14	NC
JCS = joint crack sealing; JUS = joint undersealing; WF = wet-freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze										

1. The average RFP value of the two treated SPS-4 test sections located in the DNF region is five years less than the average RFP value of the two control sections located in the same region.
2. The joint undersealing treatment of the SPS-4 test sections in the WNF, DF, and DNF regions caused higher pavement roughness and consequently the average RFP values of the control sections in the three regions are substantially lower than the test sections.

The main reason for the differences between the average RFP values of the test sections and the control sections is that the conditions of the control sections are not representative of the conditions of the test sections when they were subjected to treatments. For example, the IRI value obtained from the first survey performed on the treated test section 06B420 is 2.4 m/km while the IRI value of the control section 06B430 is 1.9 m/km. Since the magnitude and the rates of deterioration of the two test sections are different, they precipitate differences in their RFP values.

6.4.2 Longitudinal Cracking

The calculated minimum, maximum, and average RSP values based on longitudinal cracking data for the SPS-4 test sections that were subjected to the same treatment type and for the associated control sections are listed in Table 6.17. The data in the table indicate that neither treatment has any impact on the average RFP values of the SPS-4 test sections located in the WNF region. No test or control sections are located in the other three climatic regions.

6.4.3 Transverse Cracking

The calculated minimum, maximum, and average RSP values based on transverse cracking of the SPS-4 test sections that were subjected to the same treatment type and for the associated control sections are listed in Table 6.18. The data in the table indicate that:

- Joint and crack sealing has positive impact on pavement performance in the WF region. The RFP value of the one SPS-4 test section is four years higher than the average RFP of the two control sections. Whereas, the same treatment caused losses in the average RFP values of the SPS-4 test sections located in the WNF and DF regions.
- The two SPS-4 test sections located in the WNF region and subjected to joint undersealing performed worse than the three control sections by nine years.

6.5 Summary, Conclusions, and Recommendations, SPS-4

The available data in the LTPP database standard release 28 regarding the LTPP SPS-4 experiment were downloaded, organized, and analyzed. The intent was to study the impact of two maintenance treatments, joint and crack sealing (410) and joint undersealing (420), on pavement performance. When the data were separated based on traffic levels, the number of test sections that were available for analyses in each traffic level was statistically insignificant. Therefore, the data were grouped based on the two maintenance treatment types and the four climatic regions. For each group, the minimum, maximum, and average RFP and RSP values for the test and control sections were calculated and are listed in Tables 6.16 through 6.18. The impacts of the two maintenance treatments in each climatic region were presented in the previous section. Based on the results of the analyses, the following conclusions were drawn:

1. On average, relative to IRI, joint and crack sealing treatment has no impact on pavement performance in the WF region, positive impact in the WNF region, and negative impact in the DF and DNF regions.
2. On average, relative to IRI, joint undersealing treatment has negative impact on pavement performance in the WNF, DF, and DNF regions.

3. On average, the two maintenance treatments have no impact on pavement performance relative to longitudinal cracking in the WNF region.
4. Joint and crack sealing treatment has positive impact on pavement performance in the WF region and negative impact in the WNF region.
5. Likewise, joint undersealing treatment has no impact on the pavement performance relative to transverse cracking in the WNF region.

Based on the above, joint and crack sealing is effective in the WF region and not effective in the other three climatic regions. While joint undersealing is not effective in any region.

6.6 Impacts of Rehabilitation Treatments on Pavement Condition and Distress Using the LTPP SPS-6 Test Sections

The main objective of the SPS-6 experiment is to examine the effects of various rehabilitation treatments on the performance of rigid pavement test sections. The fourteen SPS-6 test sites were initiated between 1989 and 1998 and are distributed across the USA and Canada. Each SPS-6 test site consists of one control section and seven treated test sections for a total of 112 test sections. Each of the seven treated sections were subjected to one of the following rehabilitation actions:

1. Minimum restoration (602)
2. Minimum restoration with 4-inch AC overlay (603)
3. Minimum restoration with 4-inch AC overlay and sawed and sealed joints in the AC (604)
4. Maximum restoration (605)
5. Maximum restoration with 4-inch AC overlay (606)
6. Crack, break, and seat with 4-inch AC overlay (607)

7. Crack, break, and seat with 8-inch AC overlay (608)

The minimum restoration action includes limited patching, crack sealing, and joint stabilization. Further, diamond grinding was performed when faulting was considered too high. Maximum restoration includes sub-sealing, sub-drainage, joint repair and sealing, full-depth repairs and load transfer restoration, and diamond grinding. Cracking and seating was used for jointed plain concrete pavement (JPCP) test sections while breaking and seating was performed for jointed reinforced concrete pavement (JRCP) test sections.

For each SPS-6 test section subjected to one of the above listed rehabilitation actions, the time series pavement condition and distress data (collected after the rehabilitation action was taken and before the next treatment was applied) were used to calculate the RFP and RSP values of that section. Thus, the RFP and RSP values express the pavement service period between rehabilitation and the time when the pavement condition or distress reaches the pre-specified threshold values. Similarly, the RFP and RSP values of the control sections were also calculated. For each pavement condition (IRI) and distress type (rut depth and alligator, longitudinal, and transverse cracking), the treatment benefits were expressed in two terms as follows:

1. The RFP or the RSP value of the treated pavement section.
2. The difference in the RFP or RSP value of the treated pavement section and the RFP or RSP value of the associated control section. This difference is labeled “change in functional period (CFP) or change in structural period (CSP)”.

Results of the analyses of the treatment benefits are listed in Tables 6.19 through 6.23 based on two climatic regions (no test sections are present in the DF and DNF regions), pavement type, and pavement condition and distress type. The data in the tables are discussed below per pavement condition and distress type.

6.6.1 International Roughness Index (IRI)

The data listed in Table 6.19 indicate that:

1. Although the RFP and CFP of some treated pavement sections are listed in the table, the results are based on only one test section and one control section. Hence, no substantial discussion and/or conclusion can be made at this time.
2. Based on the limited number of test sections in each treatment type, it appears that, on average:
   - The maximum restoration and no AC overlay treatment type yielded the lowest RFP value. This could be related to the treatment type or more likely the construction quality that yielded high pavement roughness.
   - The impact of rigid pavement type and climatic region on the performance of the treated test sections is similar.

6.6.2 Rut depth

The data listed in Table 6.20 indicate that:

1. Although the test sections which received AC overlay have rut depth measurements available in the LTPP database, the PCC control sections were not subjected to AC overlay and hence do not have rut depth data. Therefore, no CFP/CSP values could be calculated.
2. Once again, although the RFP/RSP values of most treated pavement sections are listed in the table, the data in each category (each cell in the table) are based on only one test section. Nevertheless, the data in the table indicate that the RFP/RSP values of all treated pavement sections, where a minimum of three data points were collected, is twenty years regardless of the treatment type, pavement type, or climatic region.

Table 6.19 The RFP of control sections and the impact of treatment types on pavement performance in terms of RFP based on IRI

C.R	Pave-ment type	State (state code)	Control section RFP (year)	Minimum restoration and no AC overlay		Minimum restoration and AC overlay				Maximum restoration and no AC overlay		Maximum restoration and 4-inch AC overlay		Crack/break and seat and AC overlay			
						4-inch		4-inch with SS						4-inch		8-inch	
				RFP	CFP	RFP	CFP	RFP	CFP	RFP	CFP	RFP	CFP	RFP	CFP	RFP	CFP
WF	JPCP	AZ (04)	ND	ND	-	18	-	20	-	ND	-	20	-	20	-	20	-
		IN (18)	ND	NS	-	20	-	20	-	NS	-	20	-	14	-	20	-
		MO (29)	ND	20	-	20	-	10	-	16	-	15	-	20	-	20	-
		SD (46)	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
		Average	-	20	-	19	-	17	-	16	-	18	-	18	-	20	-
	JRCP	IL (17)	7	20	13	20	13	20	13	13	6	ND	-	20	13	20	13
		IA (19)	ND	ND	-	ND	-	ND	-	20	-	20	-	20	-	20	-
		MI (26)	11	ND	-	20	9	NS	-	3	-8	20	9	NS	-	20	9
		MO (29)	ND	ND	-	20	-	20	-	ND	-	20	-	ND	-	20	-
		PA (42)	ND	ND	-	19	-	20	-	ND	-	19	-	20	-	20	-
		Average	9	20	11	20	11	20	11	12	3	20	11	20	11	20	11
WNF	JPCP	AL (01)	0	20	20	20	20	20	20	20	20	20	20	ND	-	20	20
		AK (05)	ND	20	-	20	-	20	-	ND	-	20	-	20	-	20	-
		CA (06)	0	ND	-	15	15	ND	-	7	7	ND	-	16	16	20	20
		TN (47)	ND	15	-	20	-	13	-	ND	-	20	-	ND	-	20	-
		Average	0	18	18	19	19	18	18	14	14	20	20	18	18	20	20
	JRCP	OK (40)	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-

JPCP = jointed plain concrete pavements; JRCP = jointed reinforced concrete pavements; WF = wet-freeze; WNF = wet-no-freeze; RFP = remaining functional period; CFP = change in functional period; SS = saw and seal of joints; ND = no data; NA = not applicable; NS = negative model slope (pavement condition and/or distress improving over time with no treatment); "-" = cannot be calculated

Table 6.20 Impact of various treatments and control section on pavement performance in terms of RFP/RSP based on rut depth

C.R	Pavement type	State (state code)	Control section RSP (year)	Minimum restoration and no AC overlay		Minimum restoration and AC overlay				Maximum restoration and no AC overlay		Maximum restoration and 4-inch AC overlay		Crack/break and seat and AC overlay			
						4-inch		4-inch with SS						4-inch		8-inch	
				RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP
WF	JPCP	AZ (04)	NA	NA	-	20	-	20	-	NA	-	NS	-	20	-	20	-
		IN (18)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-
		MO (29)	NA	NA	-	NS	-	NS	-	NA	-	NS	-	NS	-	NS	-
		SD (46)	NA	NA	-	ND	-	ND	-	NA	-	ND	-	ND	-	ND	-
		Average	-	-	-	20	-	20	-	-	-	20	-	20	-	20	-
	JRCP	IL (17)	NA	NA	-	20	-	20	-	NA	-	ND	-	NS	-	NS	-
		IA (19)	NA	NA	-	NS	-	20	-	NA	-	NS	-	NS	-	20	-
		MI (26)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-
		MO (29)	NA	NA	-	20	-	20	-	NA	-	20	-	ND	-	20	-
		PA (42)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-
		Average	-	-	-	20	-	20	-	-	-	20	-	20	-	20	-
WNF	JPCP	AL (01)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-
		AK (05)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-
		CA (06)	NA	NA	-	20	-	20	-	NA	-	ND	-	20	-	20	-
		TN (47)	NA	NA	-	20	-	20	-	NA	-	20	-	ND	-	20	-
		Average	-	-	-	20	-	20	-	-	-	20	-	20	-	20	-
	JRCP	OK (40)	NA	NA	-	20	-	20	-	NA	-	20	-	20	-	20	-

JPCP = jointed plain concrete pavements; JRCP = jointed reinforced concrete pavements; WF = wet-freeze; WNF = wet-no-freeze; RFP = remaining functional period; CFP = change in functional period; SS = saw and seal of joints; ND = no data; NA = not applicable; NS = negative model slope (pavement condition and/or distress improving over time with no treatment); "-" = cannot be calculated

Table 6.21 Impact of various treatments and control section on pavement performance in terms of RSP based on alligator cracking

Climatic region	Pavement type	State (state code)	Control section RSP (year)	Minimum restoration and no AC overlay		Minimum restoration and AC overlay				Maximum restoration and no AC overlay		Maximum restoration and 4-inch AC overlay		Crack/break and seat and AC overlay			
						4-inch		4-inch with SS						4-inch		8-inch	
				RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP
WF	JPCP	AZ (04)	NA	NA	-	13	-	20	-	NA	-	19	-	19	-	20	-
		IN (18)	NA	NA	-	20	-	13	-	NA	-	11	-	12	-	12	-
		MO (29)	NA	NA	-	ND	-	15	-	NA	-	19	-	19	-	20	-
		SD (46)	NA	NA	-	ND	-	ND	-	NA	-	ND	-	ND	-	ND	-
		Average	-	-	-	17	-	16	-	-	-	16	-	17	-	17	-
	JRCP	IL (17)	NA	NA	-	5	-	13	-	NA	-	ND	-	ND	-	18	-
		IA (19)	NA	NA	-	ND	-	8	-	NA	-	8	-	8	-	10	-
		MI (26)	NA	NA	-	20	-	ND	-	NA	-	10	-	ND	-	20	-
		MO (29)	NA	NA	-	ND	-	20	-	NA	-	ND	-	ND	-	16	-
		PA (42)	NA	NA	-	20	-	ND	-	NA	-	ND	-	20	-	ND	-
		Average	-	-	-	15	-	14	-	-	-	9	-	14	-	16	-
WNF	JPCP	AL (01)	NA	NA	-	9	-	15	-	NA	-	ND	-	3	-	7	-
		AK (05)	NA	NA	-	18	-	16	-	NA	-	18	-	20	-	20	-
		CA (06)	NA	NA	-	7	-	ND	-	NA	-	ND	-	5	-	7	-
		TN (47)	NA	NA	-	ND	-	12	-	NA	-	ND	-	ND	-	ND	-
		Average	-	-	-	11	-	14	-	-	-	18	-	9	-	11	-
	JRCP	OK (40)	NA	NA	-	20	-	20	-	NA	-	20	-	5	-	9	-

JPCP = jointed plain concrete pavements; JRCP = jointed reinforced concrete pavements; WF = wet-freeze; WNF = wet-no-freeze; RFP = remaining functional period; CFP = change in functional period; SS = saw and seal of joints; ND = no data; NA = not applicable; NS = negative model slope (pavement condition and/or distress improving over time with no treatment); “-“ = cannot be calculated

Table 6.22 Impact of various treatments and control section on pavement performance in terms of RSP based on longitudinal cracking

Climatic region	Pavement type	State (state code)	Control section RSP (year)	Minimum restoration and no AC overlay		Minimum restoration and AC overlay				Maximum restoration and no AC overlay		Maximum restoration and 4-inch AC overlay		Crack/break and seat and AC overlay			
						4-inch		4-inch with SS						4-inch		8-inch	
				RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP
WF	JPCP	AZ (04)	ND	ND	-	7	-	12	-	ND	-	13	-	10	-	13	-
		IN (18)	ND	19	-	6	-	12	-	20	-	14	-	15	-	10	-
		MO (29)	20	ND	-	10	-10	6	-14	13	-7	9	-11	10	-10	10	-10
		SD (46)	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
		Average	20	19	1	8	-12	10	-10	17	-3	12	-8	12	-8	11	-9
	JRCP	IL (17)	13	ND	-	20	7	12	-1	ND	-	ND	-	20	7	17	4
		IA (19)	ND	ND	-	ND	-	7	-	ND	-	3	-	0	-	1	-
		MI (26)	19	ND	-	10	-9	ND	-	NS	-	10	-9	9	-10	9	-10
		MO (29)	ND	ND	-	ND	-	19	-	ND	-	20	-	ND	-	20	-
		PA (42)	ND	ND	-	14	-	15	-	ND	-	14	-	14	-	17	-
		Average	16	-	-	15	-1	13	-3	-	-	12	-4	11	-5	13	-3
WNF	JPCP	AL (01)	ND	20	-	5	-	6	-	ND	-	5	-	7	-	20	-
		AK (05)	ND	ND	-	10	-	10	-	ND	-	12	-	9	-	9	-
		CA (06)	ND	ND	-	6	-	7	-	ND	-	7	-	5	-	5	-
		TN (47)	ND	20	-	6	-	5	-	ND	-	5	-	ND	-	7	-
		Average	-	20	-	7	-	7	-	-	-	7	-	7	-	10	-
	JRCP	OK (40)	ND	ND	-	3	-	3	-	ND	-	3	-	3	-	3	-

JPCP = jointed plain concrete pavements; JRCP = jointed reinforced concrete pavements; WF = wet-freeze; WNF = wet-no-freeze; RFP = remaining functional period; CFP = change in functional period; SS = saw and seal of joints; ND = no data; NA = not applicable; NS = negative model slope (pavement condition and/or distress improving over time with no treatment); "-" = cannot be calculated

Table 6.23 Impact of various treatments and control section on pavement performance in terms of RSP based on transverse cracking

Climatic region	Pavement type	State (state code)	Control section RSP (year)	Minimum restoration and no AC overlay		Minimum restoration and AC overlay				Maximum restoration and no AC overlay		Maximum restoration and 4-inch AC overlay		Crack/break and seat and AC overlay			
						4-inch		4-inch with SS						4-inch		8-inch	
				RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP	RSP	CSP
WF	JPCP	AZ (04)	ND	ND	-	3	-	0	-	ND	-	7	-	8	-	12	-
		IN (18)	ND	ND	-	3	-	0	-	ND	-	3	-	3	-	16	-
		MO (29)	20	20	0	12	-8	0	-20	20	0	9	-11	11	-9	10	-10
		SD (46)	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
		Average	20	20	0	6	-14	0	-20	20	0	6	-14	7	-13	13	-7
	JRCP	IL (17)	5	0	-5	20	15	20	15	0	-5	ND	-	ND	-	20	15
		IA (19)	ND	ND	-	ND	-	NS	-	ND	-	NS	-	20	-	14	-
		MI (26)	0	ND	-	19	19	ND	-	0	0	15	15	14	14	12	12
		MO (29)	ND	ND	-	ND	-	NS	-	ND	-	20	-	ND	-	20	-
		PA (42)	ND	ND	-	20	-	NS	-	ND	-	20	-	20	-	ND	-
		Average	3	0	-3	20	17	20	17	0	-3	18	15	18	15	17	14
WNF	JPCP	AL (01)	20	20	0	7	-13	0	-20	12	-8	5	-15	4	-16	20	0
		AK (05)	ND	ND	-	8	-	0	-	ND	-	8	-	10	-	13	-
		CA (06)	ND	ND	-	6	-	ND	-	ND	-	ND	-	11	-	12	-
		TN (47)	ND	20	-	13	-	1	-	ND	-	11	-	ND	-	ND	-
		Average	20	20	0	9	-11	0	- 20	12	-8	8	-12	8	-12	15	- 5
	JRCP	OK (40)	ND	ND	-	12	-	17	-	ND	-	17	-	4	-	20	-

JPCP = jointed plain concrete pavements; JRCP = jointed reinforced concrete pavements; WF = wet-freeze; WNF = wet-no-freeze; RFP = remaining functional period; CFP = change in functional period; SS = saw and seal of joints; ND = no data; NA = not applicable; NS = negative model slope (pavement condition and/or distress improving over time with no treatment); “-“ = cannot be calculated

6.6.3 Alligator Cracking

The data listed in Table 6.21 indicate that:

1. The LTPP database has no alligator cracking data for any of the control sections. Once again, the reason is that the control sections are rigid pavement, while the test sections are composite pavements.
2. The reported alligator cracking data on the test sections are highly likely top-down cracking. The reason that in composite pavements, surface tensile stress and strain due to pavement-tire interaction is higher than the tensile stress and strain at the bottom of the AC overlay. Nevertheless, the RSP values of most treated pavement sections listed in Table 6.21 are based on only one test section per treatment type, pavement type, and climatic region. The data cannot be compared to the control sections to extract treatment benefits because of the different pavement types. However, the differential benefits of the various treatments can be obtained by studying the minimum, maximum, and average values of the RSP. The data in the table indicate that:
   - The RSP values of the test sections subjected to minimum restoration and 4-inch AC overlay ranges from a low of five years to a high of twenty years with an average of about fourteen years.
   - The RSP values of the test sections subjected to minimum restoration, sawing and sealing the joints, and 4-inch AC overlay ranges from a low of five years to a high of twenty years with an average of about fifteen years.
   - The RSP values of the test sections subjected to maximum restoration and 4-inch AC overlay ranges from a low of eight years to a high of twenty years with an average of about fifteen years.

- The RSP values of the test sections subjected to crack, break and seat, and 4-inch AC overlay ranges from a low of five years to a high of twenty years with an average of about fifteen years.
- The RSP of the test sections subjected to crack, break, and seat and 8-inch AC overlay ranges from a low of seven years to a high of twenty years with an average of about fifteen years.

3. The above observations indicate that the pavement performance of the five treatments is almost the same and independent of pavement type and climatic region.

6.6.4 Longitudinal Cracking

The data listed in Table 6.22 indicate that:

1. The LTPP database contains three or more time series data points for only 3 control sections. The other eleven sections either have less than three data points or the control section was treated before three data points were collected.
2. It appears that all treatment types of JPCP and JRCP test sections located in the WF region were not effective. The performance of the treated sections is less than the performance of the control sections.
3. For JPCP test sections located in the WNF region, it appears that the minimum restoration and no AC overlay treatment yielded the highest RSP value (twenty years). While the crack and break and seat and 8-inch AC overlay yielded RSP value of ten years. The RSP value of the test sections that received each of the other four treatments was seven years.

6.6.5 Transverse Cracking

The data listed in Table 6.23 indicate that:

1. For the JRCP test section located in Illinois (WF region), the minimum restoration and no AC overlay treatment appears not to address the transverse cracking problem; the RSP value of the treated test section is zero. Further, the RSP values of two test sections located in Illinois and Michigan and subjected to maximum restoration and no AC overlay treatment is also zero. The data from the limited number of test sections suggest that neither the minimum nor the maximum restoration with no overlay treatments address transverse cracking problems in JRCP test sections, or the treatment construction quality was not adequate, or combination thereof. On the other hand, the two treatments appear to be the right treatment for the four JPCP test sections located in the WF (two sections in Missouri) and WNF regions (two sections in Alabama).
2. The other three treatments; minimum and maximum restoration with 4-in AC overlay appear to be the right treatment for transverse cracking of JRCP test sections located in the WF region.

6.7 Summary, Conclusions, and Recommendations, SPS-6

The available data in the LTPP database standard release 28 regarding the LTPP SPS-6 experiment were downloaded, organized, and analyzed. The intent was to study the impact of seven maintenance treatments on pavement performance. Each of the seven test sections of each of the fourteen test sites was subjected to certain treatment. The measured condition and distress data for each test site and control section were analyzed and the RFP, RSP, CFP, and CSP values were calculated. The results were then grouped per pavement type and climatic region for further analyses. Unfortunately, the IRI and distress data for many control sections and for some test sections did not support the analyses because of either the lack of three data points or improvement in the pavement condition and/or distress over time without the application of treatments. Consequently, the results for only few test sections can be compared. Based on the limited number of test and control sections, the conclusions listed below were drawn. It should be noted that each of these conclusions should be handled cautiously, they are based on the results of a few and sometimes on only one test section.

1. The RFP values of the treated pavement sections are independent of pavement type and climatic region.
2. The pavement performance based on rut depth of treated test sections is independent of the treatment type, pavement type, and climatic region.
3. The alligator cracking data in the database are highly likely an advanced form of top down cracking (the top-down cracks are fatigue cracks which initiate at the pavement surface and, over time, propagate downward) where the transverse and longitudinal cracks resemble alligator cracking.
4. The performance of the test sections relative to longitudinal cracking was worse after subjecting the section to any of the seven treatment types.
5. Minimum and maximum pavement restoration with no AC overlay treatments do not improve the performance of the JRCP test sections.

6.8 Impacts of Bonded Concrete Overlays on Pavement Performance Using the LTPP SPS-7 Test Sections

The main objective of the SPS-7 experiment is to study the effects of bonded concrete overlay thickness, surface preparation before concrete overlay, and the use of cement grout on the performance of Portland cement concrete (PCC) pavements. There are four SPS-7 test sites that were initiated between 1990 and 1992. Three of the four sites consist of continuously reinforced concrete pavement (CRCP) test sections while the other four sites consist of JPCP test sections.

Each of the four test sites has eight test sections and one control section, except the test site in the Louisiana where no control section is included. The eight test sections were subjected to one of the following treatments:

1. Three-inch concrete overlay with milling and grouting (702)
2. Three-inch concrete overlay with milling (703)
3. Three-inch concrete overlay with shot blasting (704)
4. Three-inch concrete overlay with shot blasting and grouting (705)
5. Five-inch concrete overlay with shot blasting and grouting (706)
6. Five-inch concrete overlay with shot blasting (707)
7. Five-inch concrete overlay with milling (708)
8. Five-inch concrete overlay with milling and grouting (709)

For each test section that was subjected to one of the above treatments, the available time series pavement condition and distress data from the time of treatment to that of the next treatment were used to calculate the RFP and RSP values of that section. Hence the RFP and RSP values describe the time period between the treatment construction and the time when the pavement condition or distress reaches the pre-specified threshold values. The RFP and RSP values of the control sections were also calculated. For each pavement condition (IRI) and distress type (longitudinal and transverse cracking), the treatment benefits were calculated based on two terms:

1. The RFP and RSP of each treated test section
2. The difference in the RFP or RSP of the treated test section and the RFP or RSP of the control section, CFP and CSP.

Results of the analyses are listed in Tables 6.24 through 6.26 and are discussed below based on pavement condition and distress type. It should be noted that, for each of the CRCP test sections, the total transverse crack length was calculated as the sum of half of the cumulative length of low severity transverse cracks, the total length of medium severity cracks, and the total length of high severity transverse cracks. The reason is that the signature of CRCP is the tightly spaced transverse cracks (also called shrinkage cracks). Some of these transverse cracks may open up over time, connect, and produce punchouts. After careful observations of the CRCP transverse crack data, it was observed that, for most CRCP test sections, the total length of the low severity transverse cracks reported in the database exceeds the crack saturation point. Therefore, it was assumed that about half of the total length of the reported low severity transverse cracks are open enough to be considered in the analyses. The other half are very tight shrinkage cracks.

6.8.1 International Roughness Index (IRI)

Table 6.24 lists the RFP and the CFP values of all LTPP CRCP test sections located in each of the States of Iowa, Minnesota, and Louisiana and the JPCP test sections located in the State of Missouri. The data in the table indicate that:

1. In the State of Iowa, the measured time dependent IRI data of three of the eight CRCP test sections showed improvement in the IRI over time (negative slope, NS) without the application of any treatment. Hence, the RFP and CFP of the three sections were not calculated.
2. The RFP values of the other twenty-one CRCP test sections in the States of Iowa, Minnesota, and Louisiana are about twenty years (twenty years for twenty sections and seventeen years

for one section in Minnesota). That is, the data indicate that the performance of the treated CRCP test sections is independent of the eight treatment types and the two climatic regions.

3. The RFP and the CFP values of the eight JPCP test sections located in the State of Missouri appear to be related to the treatment type. The RFP values of the two test sections that were not grouted and subjected to three-inch concrete overlay with milling (703) or with shot blasting (704) are sixteen and ten years, respectively. These RFP values are 20 and 50 percent lower than the other two test sections that were grouted and subjected to 3-in overlay and the four test sections that were subjected to 5-in concrete overlays with and without grouting.

The maximum CFP value of the JPCP test sections (ten years) is mainly due to the low RFP value of the control section (10 years)

6.8.2 Longitudinal Cracking

Table 6.25 lists the RSP and the CSP values of all LTPP CRCP test and control sections located in each of the States of Iowa, Minnesota, and Louisiana and the JPCP test sections located in the State of Missouri. The data in the table indicate that:

1. In the State of Iowa, only one of the eight test sections have adequate time series longitudinal data to be analyzed. The RSP of that section is twenty years. Another test section showed improvement in the length of longitudinal cracking over time without the application of any treatment (NS). The LTPP database contains 0.1 ft long measured longitudinal cracking over time for the other six test sections and for the control section.

Table 6.24 Impact of bonded concrete overlays on pavement performance in terms of RFP based on IRI

Climatic region	Existing pavement type	State (state code)	Control section RFP (year)	The RFP and CFP of treated test sections (years)															
				Thin bonded overlay								Thick bonded overlay							
				Milling				Shot Blasting				Milling				Shot Blasting			
				G		NG		G		NG		G		NG		G		NG	
				RFP	B1	RFP	B1	RFP	B1	RFP	B1	RFP	B1	RFP	B1	RFP	B1	RFP	B1
WF	CRCP	IA (19)	20	20	0	20	0	NS	-	NS	-	20	0	20	0	NS	-	20	0
		MN (27)	ND	20	-	20	-	20	-	20	-	20	-	20	-	20	-	17	-
	JPCP	MO (29)	10	20	10	16	6	20	10	10	0	20	10	20	10	19	9	20	10
WNF	CRCP	LA (22)	NCS	20	-	20	-	20	-	20	-	20	-	20	-	20	-	NS	-

WF = wet-freeze; WNF = wet-no-freeze; G = grouting; NG = no grouting; NCS = no control section; ND = no data, no distress is observed, or less than three data points; NS = negative slope; Thin = 3 inch; Thick = 5 inch; RFP = remaining functional period (year); B1 = CFP = change in functional period (year)

Table 6.25 Impact of bonded concrete overlays on pavement performance in terms of RSP based on LC

Climatic region	Existing pavement type	State (state code)	Control section RSP (year)	The RSP and CSP of treated test sections (years)															
				Thin bonded overlay								Thick bonded overlay							
				Milling				Shot Blasting				Milling				Shot Blasting			
				G		NG		G		NG		G		NG		G		NG	
				RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1
WF	CRCP	IA (19)	ND	ND	-	20	-	ND	-	ND	-	ND	-	NS	-	ND	-	ND	-
		MN (27)	ND	ND	-	ND	-	ND	-	20	-	20	-	ND	-	20	-	11	-
	JPCP	MO (29)	20	ND	-	18	-2	20	0	20	0	20	0	20	0	13	-7	20	0
WNF	CRCP	LA (22)	NCS	NS	-	ND	-	ND	-	ND	-	ND	-	20	-	ND	-	20	-

WF = wet-freeze; WNF = wet-no-freeze; G = grouting; NG = no grouting; NCS = no control section; ND = no data, no distress is observed, or less than three data points; NS = negative slope; Thin = 3 inch; Thick = 5 inch; RSP = remaining structural period (year); B1 = CSP = change in structural period (year)

Table 6.26 Impact of bonded concrete overlays on pavement performance in terms of RSP based on TC

Climatic region	Existing pavement type	State (state code)	Control section RFP (year)	The RSP and CSP of treated test sections (years)															
				Thin bonded overlay								Thick bonded overlay							
				Milling				Shot Blasting				Milling				Shot Blasting			
				G		NG		G		NG		G		NG		G		NG	
				RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1	RSP	B1
WF	CRCP	IA (19)	ND	9	-	7	-	6	-	6	-	0	-	0	-	3	-	7	-
		MN (27)	ND	0	-	0	-	0	-	0	-	0	-	ND	-	0	-	2	-
	JPCP	MO (29)	20	0	-20	11	-9	9	-11	0	-20	0	-20	0	-20	0	-20	0	-20
WNF	CRCP	LA (22)	NCS	0	-	0	-	2	-	0	-	ND	-	0	-	0	-	0	-

WF = wet-freeze; WNF = wet-no-freeze; G = grouting; NG = no grouting; NCS = no control section; ND = no data, no distress is observed, or less than three data points; NS = negative slope; Thin = 3 inch; Thick = 5 inch; RSP = remaining structural period (year); B1 = CSP = change in structural period (year)

2. In the State of Minnesota, the RSP and CSP values for four test sections are listed in Table 6.25. Once again, The LTPP database contains 0.1 ft long measured longitudinal cracking over time for three test sections and for the control section and only two data points for one test section.
3. In the State of Louisiana, the RSP and CSP values for two test sections are listed in Table 6.25. Once again, The LTPP database contains 0.1 ft long measured longitudinal cracking over time for four test sections, only two data points for one test section and the data show improvement over time in the length of longitudinal cracking without the application of any treatment.
4. The RSP and CSP values of six JPCP test sections located in the State of Missouri appear to be independent of the treatment type. The RSP value of one test section that was subjected to 5-in concrete overlay with shot blasting and grouting is thirteen years; about seven years shorter than the RSP values of the other test sections. This could be the exception and not the rule. Stated differently, no decision could be or should be drawn based on only one section.

6.8.3 Transverse Cracking

Table 6.26 lists the RSP and the CSP values of most LTPP CRCP test sections located in each of the States of Iowa, Minnesota, and Louisiana and the JPCP test sections located in the State of Missouri. The LTPP database does not contain adequate data for only two CRCP test section, one is located in Minnesota and the other in Louisiana. The data in Table 6.26 indicate that all eight treatments in the two climatic regions are not successful in treating transverse cracking problems in CRCP. The time series transverse cracking data indicate that the RSP value is zero years for two test sections in Iowa, six test sections in Minnesota, and six test sections Louisiana. Further, the RSP of only one test section in each of the two states is 2 years. While the RSP values of six test sections in Iowa range from three to nine years.

6.9 Summary, Conclusions, and Recommendations, SPS-7

The LTPP SPS-7 experiment was designed to study the effects of bonded concrete overlay thickness, surface preparation before concrete overlay, and the use of cement grout on the performance of PCC pavements. Such study would be based on comparison between the performance of the test sections and the performance of compatible control sections. The pavement condition and distress data for each test and control section were downloaded from the LTPP database, organized, and analyzed to obtain the performance of the sections. Results of the analyses are listed in Tables 6.24 through 6.26. Based on the results of the analyses, the following conclusions were drawn:

1. The IRI based performance of the treated CRCP test sections is independent of the eight treatment types and the two climatic regions.
2. The performance of the JPCP test sections subjected to 3-in concrete overlay with milling (703) or with shot blasting (704) treatments appear to be lower than the performance of the other JPCP test sections subjected to the other six treatments.
3. Because of lack of adequate number of data points in the LTPP database, no specific conclusions can be made relative to longitudinal cracking performance.
4. None of the eight treatments are effective to treat transverse cracking problems of the CRCP test sections.

6.10 Impacts of Pavement Treatments on Pavement Performance Using the LTPP GPS-7 Test Sections

The LTPP GPS-7 experiment contains composite pavement test sections that were overlain prior to their assignment into the LTPP program. The experiment also includes rigid pavement test sections that were moved from other LTPP experiments after they were subjected to AC overlay or existing composite pavement test sections that were subjected to mill and fill. The test sections in the GPS-7 experiment are classified as GPS-7A, GPS-7B, GPS-7C, GPS-7D, GPS-7F and GPS-7S. Each of the classifications is explained below.

1. GPS-7A – The test sections under this classification are part of the original LTPP design. They were subjected to AC overlay prior to their assignment into the LTPP program.
2. GPS-7B – The test sections under this classification are also part of the original LTPP design. They were subjected to AC overlay following assignment into the LTPP program.
3. GPS-7C, -7D, 7F, and -7S – The test sections under these classifications do not have an experimental design associated with them. They were moved to either GPS-7C, -7D, -7F, or -7S classification from other LTPP experiments after they were subjected to rehabilitation actions. The specific classification into the four GPS-7X experiment depends on the type of pavement rehabilitation detailed below:
    - If the rigid pavement test sections from other LTPP experiments were overlain with virgin AC mixes, they were moved into the GPS-7B classification.
    - If the rigid pavement test sections from other LTPP experiments were overlain or if the existing composite pavement test sections were overlain again using recycled AC mixes, they are moved into the GPS-7C classification.
    - If the existing composite pavement test sections were overlain again using conventional AC mixes, they are moved into the GPS-7D classification.
    - If the rigid pavement test sections from other LTPP experiments were subjected to crack/break and seat before overlain using virgin or recycled AC mixes, they are moved into the GPS-7F classification.

- If the existing composite pavement test sections from other LTPP experiments were subjected to mill and fill using virgin or recycled AC mixes, they are moved into the GPS-7S classification.

Unfortunately, the number of rigid and composite pavement test sections that have more than three condition and/or distress data points before they were subjected to overlay or mill and fill treatments is extremely low. Given that the behavior of rigid pavement test sections is much different than that of a composite pavement test sections, they cannot be grouped to increase the number of test sections for analyses. However, the LTPP test sections in the GPS-7 experiment that have three or more AT time series pavement condition and/or distress data points were grouped according to the following variables:

- Two treatment types (AC overlay and mill and fill)
- AC mix type (virgin and recycled)
- Thickness types (thin ≤ 2.5 inches and thick > 2.5 inches)
- Four climatic regions (WF, WNF, DF, and DNF)
- One pavement condition (IRI)
- Four pavement distress types (rut depth, and alligator, longitudinal and transverse cracking).

After grouping, the data were analyzed to assess, in each climatic region, the impacts of treatment type, AC mix type, and thickness on the calculated RFP and RSP based on IRI, rut depth, and cracking. It should be noted that the LTPP database contains no before treatment pavement condition and distress data for any test section. Therefore, only the RFP or the RSP of the pavement sections were calculated. For each pavement condition and distress type, the average RFP and/or RSP values of the test sections located in the same climatic region were calculated and are listed in Tables 6.27 through 6.31. The data in the five tables are discussed below per pavement condition and distress type.

6.10.1 International Roughness Index (IRI)

Table 6.27 lists the average RFP values of test sections located in the same climatic zone and subjected to one of the four treatments listed in the table. The data indicate that the average RFP of the test sections is between 17 and 20 years.

6.10.2 Rut Depth

Table 6.28 lists the average RFP/RSP values of test sections located in the same climatic zone and subjected to one of the four treatments listed in the table. The data indicate that, except one test section, the average RFP of all other sections is 20 years. Again, the exemption is one test section located in the DF region and subjected to thin overlay using recycled AC mixes. Its RFP/RSP is only six years. The reason for the RFP/RSP is highly likely due problems associated with the AC mix or with construction of the overlay. The AC mix problems could be excessive binder content, or unstable mix. While construction issue could be inadequate compaction of the overlay or the early opening the road to traffic.

6.10.3 Alligator Cracking

Table 6.29 lists the average RSP values of test sections located in the same climatic zone and subjected to one of the four treatments listed in the table. It is important to note that, the labeling of "Alligator Cracking" is highly likely not related to bottom up fatigue cracks in composite pavements. The label is most likely related to advanced stages of top-down fatigue cracking.

Table 6.27 Impacts of various treatment types on the RFP of the test sections based on IRI

Treatment type	Mix type	Thickness	Number of test sections and the RFP values in the designated climatic region							
			WF		WNF		DF		DNF	
			No.	RFP (year)	No.	RFP (year)	No.	RFP (year)	No.	RFP (year)
Overlay	Virgin	Thin	6	18	0	-	0	-	0	-
		Thick	25	19	6	20	1	20	1	20
	Recycled	Thin	2	20	1	20	1	20	0	-
		Thick	0	-	0	-	1	20	1	20
Mill and Fill	Virgin	Thin	3	20	2	17	1	20	0	-
		Thick	3	20	2	20	0	-	0	-
	Recycled	Thin	1	20	0	-	0	-	0	-
		Thick	0	-	0	-	0	-	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (>2.5 inch), RFP = Remaining functional period;

Table 6.28 Impacts of various treatment types on the RFP/RSP of the test sections based on RD

Treatment type	Mix type	Thickness	Number of test sections and the RFP/RSP values in the designated climatic region							
			WF		WNF		DF		DNF	
			No.	RFP/RSP (year)	No.	RFP/RSP (year)	No.	RFP/RSP (year)	No.	RFP/RSP (year)
Overlay	Virgin	Thin	4	20	0	-	0	-	0	-
		Thick	20	20	6	20	0	-	0	-
	Recycled	Thin	0	-	0	-	1	6	0	-
		Thick	0	-	1	20	0	-	0	-
Mill and Fill	Virgin	Thin	3	20	1	20	1	20	0	-
		Thick	3	20	1	20	0	-	0	-
	Recycled	Thin	1	20	0	-	0	-	0	-
		Thick	0	-	0	-	0	-	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (>2.5 inch), RFP/RSP = Remaining functional/structural period (RFP/RSP)

Nevertheless, the data in the table indicate that the average RSP values vary from nine to twenty years as detailed below:

1. In the WF region, the average RSP of the test sections that were subjected to thin overlay and mill and fill treatment treatments using virgin AC mixes is 19 and 20 years, respectively. While the average RSP of the test sections that were subjected to thick overlay and mill and fill treatments using virgin AC mixes is 14 and 12 years, respectively. Further, the RSP of thin overlay treatment using recycled AC mixes is only 9 years.
2. The RSP of the eight test sections located in the WNF region varies from 11 to 20 years.
3. In the DF region, the RSP of the one test section subjected to thin mill and fill treatment using virgin AC mix is 20 years.
4. In the DNF region, the RSP of the one test section subjected to thick overlay treatment using virgin AC mix is 10 years.

Given the limited number of test sections that received certain treatments and located in climatic regions, and given the lack of pavement condition and distress data before treatment, no decision can be made regarding the variability or the functionality of the RSP after treatment.

6.10.4 Longitudinal Cracking

Table 6.30 lists the average RSP values of test sections located in the same climatic zone and subjected to one of the four treatments listed in the table. The data in the table indicate that the average RSP values vary from four to 15 years as detailed below.

1. In the WF region, the average RSP of the test sections that were subjected to thin overlay and mill and fill treatment treatments using virgin AC mixes is 6 and 9 years, respectively. While the average RSP values of the test sections that were subjected to thick overlay and mill and fill treatments using virgin AC mixes are 8 and 6 years, respectively. Further, the RSP of thin

mill and fill treatment using recycled AC mixes is only 5 years.

2. The RSP of the 11 test sections located in the WNF region varies from 4 to 15 years.
3. In the DF region, the three test sections have an RSP value of 8 years.
4. In the DNF region, the average RSP of the test sections subjected to thick overlay treatment using virgin AC mix is 10 years.

Given the limited number of test sections that received certain treatments and located in climatic regions, and given the lack of pavement condition and distress data before treatment, no decision can be made regarding the variability or the functionality of the RSP after treatment.

6.10.5 Transverse Cracking

Table 6.31 lists the average RSP values of test sections located in the same climatic region and subjected to one of the four treatments listed in the table. The data in the table indicate that the average RSP values vary from four to 17 years as detailed below.

1. In the WF region, the average RSP of the test sections that were subjected to thin overlay and mill and fill treatments using virgin AC mixes is 8 and 11 years, respectively. While the average RSP values of the test sections that were subjected to thick overlay and mill and fill treatments using virgin AC mixes are 11 and 16 years, respectively. Further, the RSP of thin overlay and mill and fill treatment using recycled AC mixes are 3 and 12 years respectively.
2. The RSP of the 12 test sections located in the WNF region varies from 6 to 17 years. The thicker is the AC overlay, the higher is the RSP. In the DF region, the one test section has an RSP value of 9 years. In the DNF region, the one test section has an RSP value of 13 years.

Given the limited number of test sections that received certain treatments and located in climatic regions, and given the lack of pavement condition and distress data before treatment, no decision can be made regarding the variability or the functionality of the RSP after treatment.

Table 6.29 Impacts of various treatment types on the RSP of test sections based on AlC

Treatment type	Mix type	Thickness	Number of test sections and the RFP values in the designated climatic region							
			WF		WNF		DF		DNF	
			No.	RSP (year)	No.	RSP (year)	No.	RSP (year)	No.	RSP (year)
Overlay	Virgin	Thin	2	19	1	11	0	-	0	-
		Thick	13	14	4	12	0	-	1	10
	Recycled	Thin	1	9	1	12	0	-	0	-
		Thick	0	-	1	20	0	-	0	-
Mill and Fill	Virgin	Thin	1	20	1	20	1	20	0	-
		Thick	2	12	0	-	0	-	0	-
	Recycled	Thin	0	-	0	-	0	-	0	-
		Thick	0	-	0	-	0	-	0	-
No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (>2.5 inch), RSP = Remaining structural period (RSP)										

Table 6.30 Impacts of various treatments on pavement performance in terms of RSP based on LC

Treatment type	Mix type	Thickness	Number of test sections and the RFP values in the designated climatic region							
			WF		WNF		DF		DNF	
			No.	RSP (year)	No.	RSP (year)	No.	RSP (year)	No.	RSP (year)
Overlay	Virgin	Thin	4	6	1	4	0	-	0	-
		Thick	17	8	6	8	0	-	2	10
	Recycled	Thin	0	-	0	-	1	8	0	-
		Thick	0	-	1	10	1	8	0	-
Mill and Fill	Virgin	Thin	1	9	1	15	1	8	0	-
		Thick	3	6	2	13	0	-	0	-
	Recycled	Thin	2	5	0	-	0	-	0	-
		Thick	0	-	0	-	0	-	0	-
No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (>2.5 inch), RSP = remaining structural period										

Table 6.31 Impacts of various treatments on pavement performance in terms of RSP based on TC

Treatment type	Mix type	Thickness	Number of test sections and the RFP values in the designated climatic region							
			WF		WNF		DF		DNF	
			No.	RSP (year)	No.	RSP (year)	No.	RSP (year)	No.	RSP (year)
Overlay	Virgin	Thin	4	8	1	6	0	-	0	-
		Thick	16	11	6	17	0	-	1	13
	Recycled	Thin	1	3	1	7	0	-	0	-
		Thick	0	-	1	17	0	-	0	-
Mill and Fill	Virgin	Thin	1	11	1	17	1	9	0	-
		Thick	4	16	2	16	0	-	0	-
	Recycled	Thin	2	12	0	-	0	-	0	-
		Thick	0	-	0	-	0	-	0	-

No. = number of test sections; WF = wet freeze; WNF = wet-no-freeze; DF = dry-freeze; DNF = dry-no-freeze; Thin = (≤ 2.5 inch); Thick = (>2.5 inch), RSP = remaining structural period

CHAPTER 7

STATE DATA ANALYSES

7.1 Background

Results of the analyses of the LTPP time series pavement condition and distress data measured along flexible and rigid pavement test sections are presented and discussed in previous chapters. The results are presented based on treatment type, climatic regions, and various other factors. This chapter addresses the similarities and differences between the LTPP data and the pavement condition and distress data measured by the three States of Colorado, Louisiana, and Washington along various pavement segments of their respective pavement networks. The differences between the LTPP and the state data are enumerated below.

1. The LTPP data were measured along 152.4 m long test and control sections located throughout USA and Canada. Whereas, the state data were measured along 0.5 to 8-mile-long pavement projects and stored in the databases for each 0.1-mile-long pavement segment along the project. Thus, the data for an 8-mile-long pavement project are stored in eighty different fields; one field per 0.1 mile.
2. The units of measurement used by the LTPP program are not the same as those used by the SHAs. For example, the LTPP unit of measurement for IRI is m/km while it is inch/mile for the states. Therefore, prior to the analyses of the state data, the data were converted to the same units as the LTPP data.
3. The pavement condition and distress along one single LTPP test section represents one single data point in time. Whereas, for each pavement project, the state data contains as many data points at one time as the number of 0.1-mile-long pavement segments along the project. For

example, the data from one survey of an 8-mile-long pavement project is equivalent to 80 LTPP test sections.

4. The SHA's databases are based on their distress identification definitions and procedures, which may or may not be compatible with the LTPP Distress Identification Manual.
5. The SHA's databases lack details of the types, classifications, and properties of the pavement layers and roadbed soils.

The LTPP data contain the pavement conditions and distresses of flexible, rigid and composite pavements test and control sections. Although the data from the three SHAs contain the same, the number of rigid and composite pavement projects that received treatments and the database contains three or more data points is very much limited. Hence, it was decided to limit the comparison to flexible pavement sections only.

An effort has been made to compare the results of the analyses of the LTPP and state data and to determine whether or not the methodologies used in the analyses of the LTPP data apply equally to the state data as well. Therefore, the pavement condition and distress data for the three pavement networks of the three SHAs were requested from the three SHAs, received, organized, and were subjected to the same types of analyses as the LTPP data using the step by step procedure detailed in the next section.

7.2 Analysis Procedure Steps

In this section, the steps of the procedure used in the analyses of the state data are presented. These steps are similar as those used in the analyses of the LTPP data. The difference is that the LTPP test sections are analyzed individually. On the other hand, a pavement project consists of many 0.1-mile-long pavement segments where the pavement condition and distress vary substantially along the project. Although each 0.1-mile-long pavement segment along a given pavement project was analyzed individually, results of the analyses of each project within a SHA that received the same treatment were grouped into the five condition states system based on the RFP and RSP values of each 0.1-mile segment. The system was developed in this study and presented in Chapter 3 (Pavement Condition and Classification). Finally, the benefits of a given treatment type were calculated as the weighted average benefits of each 0.1-mile-long pavement segment within each state using the RFP or RSP, the CFP or CSP and the FCROP or SCROP. For the LTPP data, the benefits were calculated using the same parameters based on the weighted average benefits of each test section that received the same treatment type and located in any of the four climatic regions. The analyses procedure steps are detailed below:

Step 1 - The pavement condition and distress data were converted into Excel spreadsheet format and separated per pavement type.

Step 2 – For each pavement network, the treatment data were searched and each 0.1-mile-long segment of several pavement projects that received one of the following treatments were identified, copied, and stored in a separate Excel datasheet.

- Thin overlay (≤ 2.5 inch)
- Thick overlay (> 2.5 inch)
- Thin mill and fill (≤ 2.5 inch)
- Thick mill and fill (> 2.5 inch)
- Single chip seal

Step 3 – The pavement condition and distress data for each identified 0.1-mile-long pavement segment were examined to determine whether or not the segment has a minimum of three-time series data that can be modeled using the proper mathematical function. Those segments that did not pass the test were not included in the analyses. Table 7.1

summarizes the number of 0.1-mile-long pavement segments that were accepted for analyses for each treatment type in each state.

The above efforts yielded the numbers of 0.1-mile-long pavement segments listed in Table 7.1, which were subjected to analyses. The table also lists the number of LTPP test sections that received similar treatment type and were analyzed. The results of these LTPP test sections were compared to those of the 0.1-mile-long pavement segments.

Step 4 – The data for each 0.1-mile-long pavement segment of each project were analyzed and the remaining functional and structural periods (RFP and RSP) before treatment were calculated.

Step 5 – For each 0.1-mile-long pavement segment, the treatment benefits were calculated in terms of the RFP or RSP after treatment, the changes in the functional and structural periods (CFP or CSP), and the functional and structural condition reoccurrence period (FCROP or SCROP). The treatment benefits were then compared to the treatment benefits obtained from the LTPP test sections. One issue that should be noted is that, the history of the 0.1-mile-long pavement segments and the treatment dates are different from one pavement project to another and from one LTPP test section to another. In order to compare the benefits using an equivalent reference, the RFP and RSP were calculated from the treatment time to the time when the pavement reaches the pre-specified threshold value. Stated differently, the calculated RFP and RSP of each 0.1-mile-long pavement segment and of the LTPP test sections represent the time in years from the treatment date to the time when the pre-specified threshold value is reached. Further, the same threshold values were used in the analyses of the state and the LTPP data.

Table 7.1 Number of available 0.1-mile-long pavement segments and LTPP test sections

Treatment type	Data source	Number of 0.1-mile-long pavement segments and LTPP test sections available for analyses				
		IRI	Rut depth	Alligator cracking	Longitudinal cracking	Transverse cracking
Thin overlay	Washington	349	709	1,746	1,000	1,538
	Colorado	94	126	128	129	70
	Louisiana	219	224	202	71	134
	SPS-3 & 5	36	35	34	40	37
	GPS-5	25	19	7	7	13
Thick overlay	Washington	10	122	403	310	220
	Colorado	No data	No data	No data	No data	No data
	Louisiana	1,416	1,242	1,199	595	984
	GPS-5	14	15	10	15	13
	GPS-6	15	13	5	2	6
Thin mill and fill	Washington	123	701	886	357	633
	Colorado	28	74	49	38	24
	Louisiana	163	191	146	80	135
	GPS-5	13	13	13	17	16
	GPS-6	27	33	9	22	6
Thick mill and fill	Washington	No data	No data	No data	No data	No data
	Colorado	No data	No data	No data	No data	No data
	Louisiana	735	957	605	286	396
	GPS-5	14	14	13	15	14
	GPS-6	12	13	3	3	4
Chip seal	Washington	52	38	156	111	194
	Colorado	50	12	43	35	52
	Louisiana	1,089	574	1,605	772	819
	SPS-3	21	22	18	21	17

Step 6 – The results of the analyses of the 0.1-mile-long pavement segments were grouped per 6 treatment transition matrices (T^2Ms), which are included in Tables F.1 through F.60 of Appendix F. The T^2Ms list the before and after treatment condition states for all 0.1-mile-long pavement segments that were analyzed. The T^2Ms also list the benefits of the treatments in term of RFP/RSP, CFP/CSP, and FCROP/SCROP and their averages.

Step 7 – Results of the analyses of all LTPP test sections (the numbers are also listed in Table 7.1) that were subjected to one of the above listed treatments and located in any climatic region were grouped for each pavement condition and distress type. The weighted average benefits in terms of RFP/RSP, CFP/CSP, and FCROP/SCROP were then calculated.

Step 8 – The two sets of benefits were then compared per pavement condition and distress type, as detailed in the following sections.

7.3 International Roughness Index (IRI)

Table 7.2 provides a summary of the calculated benefits (relative to IRI) for all 0.1-mile-long pavement segments within each SHA that received the indicated treatment type and the comparable LTPP test sections. The table also lists the number of 0.1-mile-long segments and the number of LTPP test sections involved in the analyses. For the ease of visual comparison of the benefits, they were plotted in a bar chart format as shown in Figures 7.1 through 7.3. Examination of the three figures indicate that the benefits, relative to IRI in terms of the RFP, CFP, and FCROP of each treatment type of the LTPP SPS and GPS test sections and of the 0.1-mile-long pavement segments in each of the cited SHAs, are very similar.

7.4 Rut Depth

Table 7.3 provides a summary of the calculated benefits (relative to rut depth) for all 0.1-mile-long pavement segments within each cited SHA that received the indicated treatment type and the comparable LTPP test sections. The table also lists the number of 0.1-mile-long segments and the number of LTPP test sections involved in the analyses. For the ease of visual comparison of the benefits, they were plotted in a bar chart format as shown in Figures 7.4 through 7.6. Examination of the three figures indicate that the benefits, in terms of the RFP/RSP, CFP/CSP, and FCROP/SCROP of each treatment type of the LTPP test sections and of the 0.1-mile-long pavement segments in each of the cited SHAs, are very similar.

Table 7.2 Comparison of the weighted average treatment benefits based on IRI of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Treatment type	Data source	Number of 0.1-mile-long segments/ test sections	Treatment benefits (year)		
			RFP	CFP	FCROP
Thin overlay	Washington	349	19	9	13
	Colorado	94	11	1	3
	Louisiana	219	18	14	17
	SPS-3 & 5	36	18	11	11
	GPS-6	25	19	10	13
Thick overlay	Washington	10	20	4	10
	Louisiana	1,416	19	14	18
	SPS-5	14	20	7	18
	GPS-6	15	20	14	16
Thin mill and fill	Washington	123	19	7	14
	Colorado	28	14	8	10
	Louisiana	163	18	11	15
	SPS-5	13	20	8	19
	GPS-6	27	18	7	6
Thick mill and fill	Louisiana	735	18	12	16
	SPS-5	14	20	8	19
	GPS-6	12	20	12	15
Chip seal	Washington	52	12	4	2
	Colorado	50	16	4	0
	Louisiana	1,089	12	2	-1
	SPS-3	21	15	2	4
RFP = remaining functional period; CFP = change in functional period; FCROP = functional condition re-occurrence period					

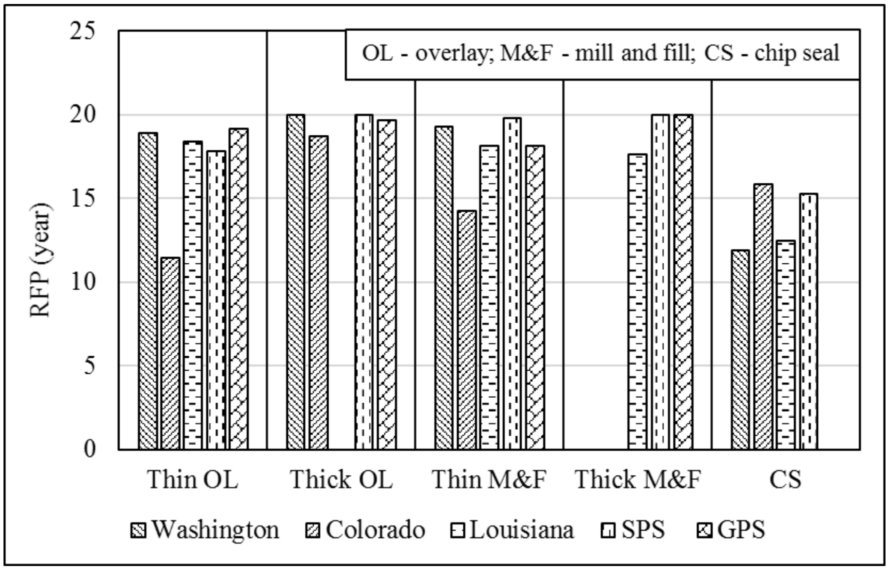


Figure 7.1 Comparison of the weighted average RFP based on IRI of five treatment types performed on LTPP test sections and on various pavement projects in three SHAs

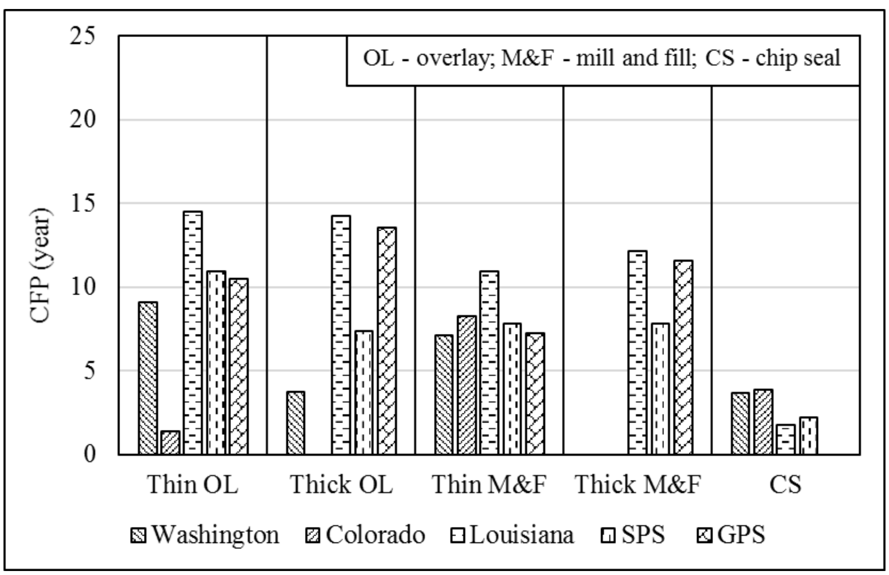


Figure 7.2 Comparison of the weighted average CFP based on IRI of five treatment types performed on LTPP test sections and on various pavement projects in three SHAs

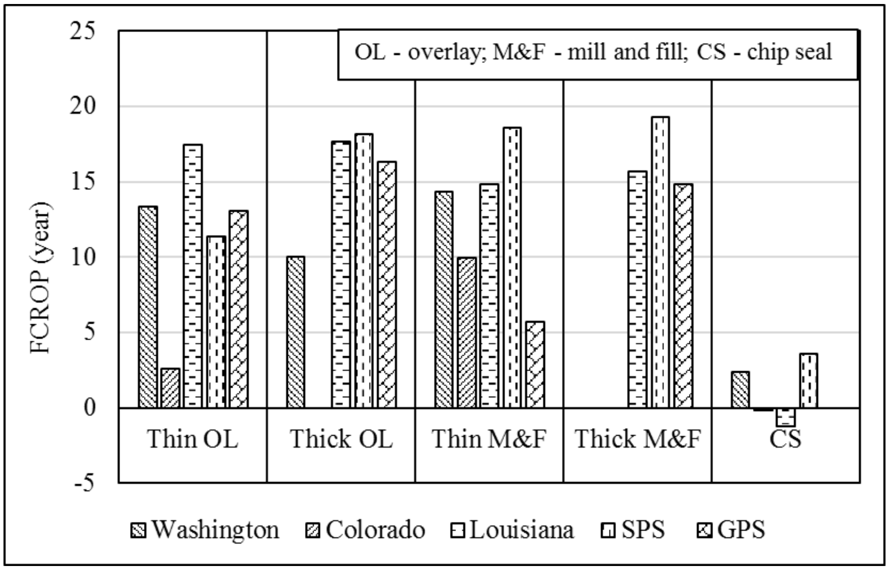


Figure 7.3 Comparison of the weighted average FCROP based on IRI of five treatment types performed on LTPP test sections and on various pavement projects in three SHAs

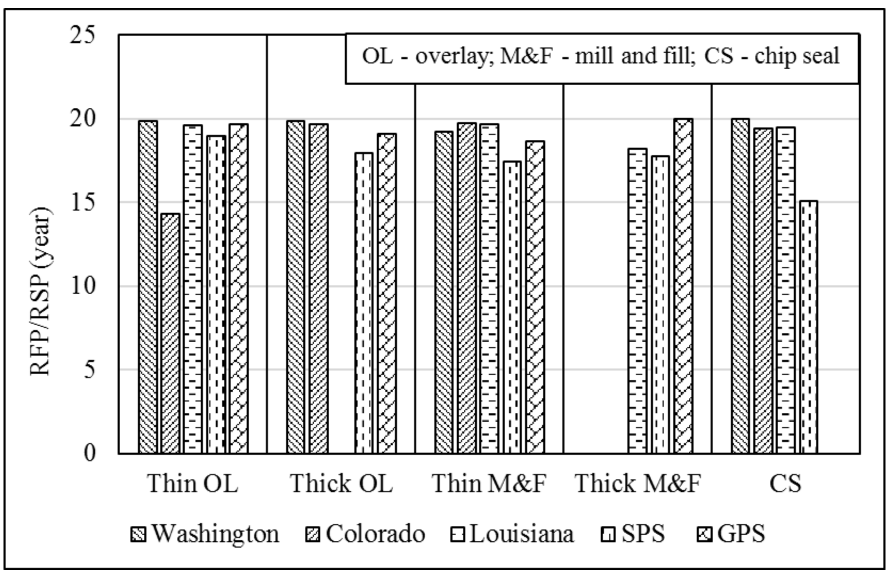


Figure 7.4 Comparison of the weighted average RFP/RSP based on rut depth of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Table 7.3 Comparison of the weighted average treatment benefits based on rut depth of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Treatment type	Data source	Rut depth			
		Number of 0.1 mile segments / test sections	RFP/RSP (year)	CFP/CSP (year)	FCROP/SCROP (year)
Thin overlay	Washington	709	20	6	15
	Colorado	126	14	-4	7
	Louisiana	224	20	4	18
	SPS-3 & 5	35	19	10	16
	GPS-6	19	20	11	18
Thick overlay	Washington	122	20	8	15
	Louisiana	1,242	20	6	10
	SPS-5	15	18	7	14
	GPS-6	13	19	11	18
Thin mill and fill	Washington	701	19	8	16
	Colorado	74	20	6	14
	Louisiana	191	20	14	19
	SPS-5	13	17	8	17
	GPS -6	33	19	14	17
Thick mill and fill	Louisiana	957	18	9	14
	SPS-5	14	18	7	17
	GPS-6	13	20	12	18
Chip seal	Washington	38	20	1	9
	Colorado	12	19	3	0
	Louisiana	574	19	6	8
	SPS-3	22	15	4	11

RFP/RSP = remaining functional/structural period; CFP/CSP = change in functional/structural period; FCROP/SCROP = functional/structural condition re-occurrence period

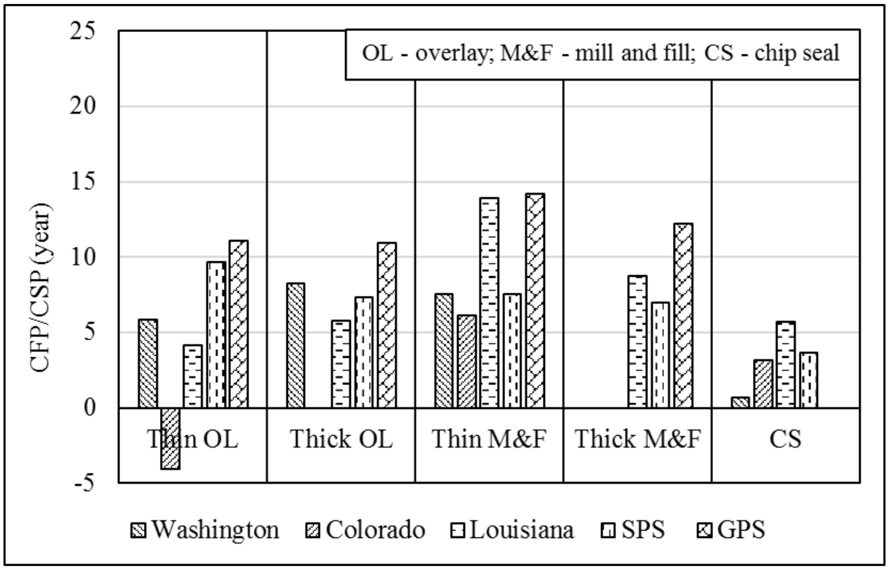


Figure 7.5 Comparison of the weighted average CFP/CSP based on rut depth of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

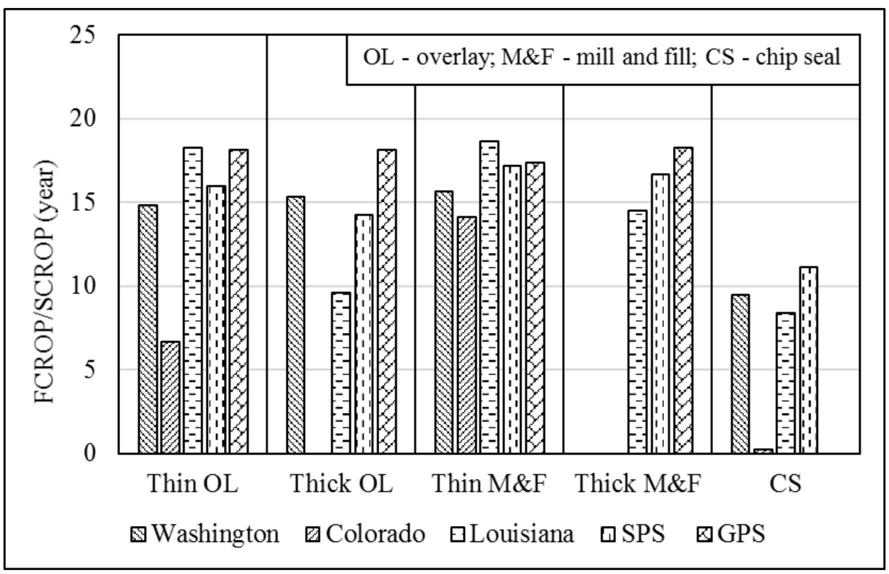


Figure 7.6 Comparison of the weighted average FCROP/SCROP based on rut depth of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

7.5 Alligator Cracking

Table 7.4 provides a summary of the average calculated benefits (relative to alligator cracking) for all 0.1-mile-long pavement segments within each cited SHA that received the indicated treatment type and the comparable LTPP test sections. The table also lists the number of 0.1-mile-long segments and the number of LTPP test sections involved in the analyses. For the ease of visual comparison of the benefits, they were plotted in a bar chart format as shown in Figures 7.7 through 7.9. Examination of the three figures indicate that the benefits of each treatment type of the LTPP test sections and of the 0.1-mile-long pavement segments in each of the cited SHAs are very similar.

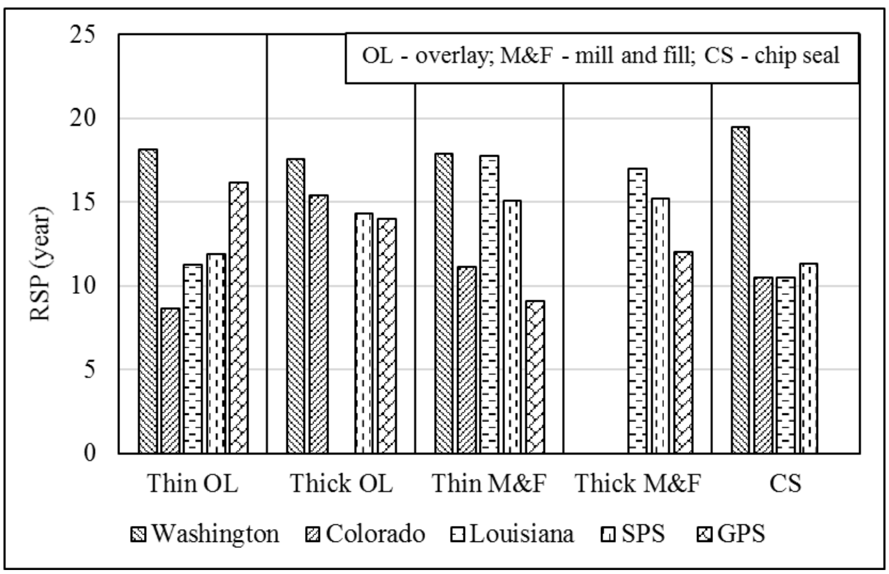


Figure 7.7 Comparison of the weighted average RSP based on alligator cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Table 7.4 Comparison of the weighted average treatment benefits based on alligator cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Treatment type	Data source	Alligator cracking			
		Number of 0.1 mile segments / test sections	RSP (year)	CSP (year)	SCROP (year)
Thin overlay	Washington	1,746	18	6	13
	Colorado	128	9	-6	0
	Louisiana	202	11	9	10
	SPS	34	12	5	6
	GPS	7	16	14	15
Thick overlay	Washington	403	18	5	14
	Louisiana	1,199	15	13	15
	SPS	10	14	7	10
	GPS	5	14	9	12
Thin mill and fill	Washington	886	18	2	10
	Colorado	49	11	3	7
	Louisiana	146	18	9	13
	SPS	13	15	7	14
	GPS	9	9	7	11
Thick mill and fill	Louisiana	605	17	15	17
	SPS	13	15	7	11
	GPS	3	12	11	13
Chip seal	Washington	156	19	2	7
	Colorado	43	10	7	5
	Louisiana	1,605	10	8	9
	SPS	18	11	1	6
RSP = remaining structural period; CSP = change in structural period; SCROP = structural condition re-occurrence period					

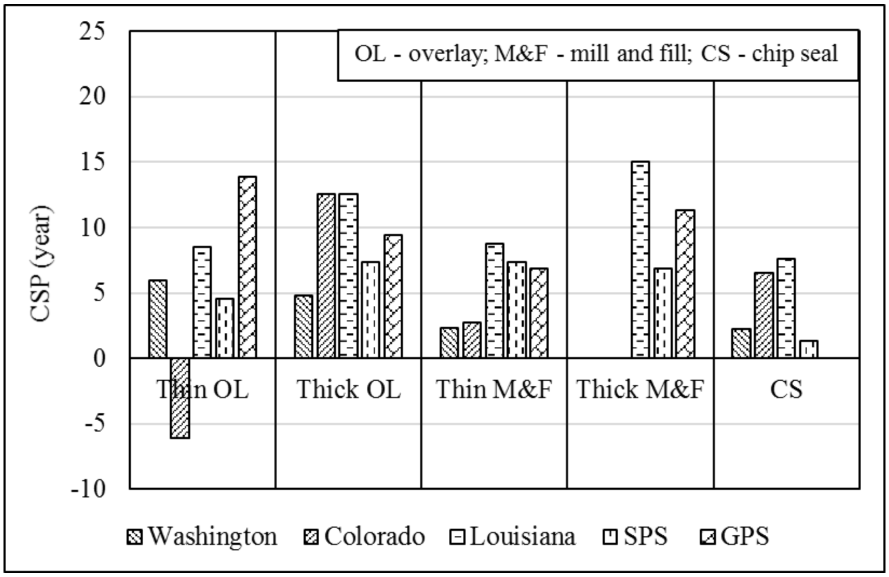


Figure 7.8 Comparison of the weighted average CSP based on alligator cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

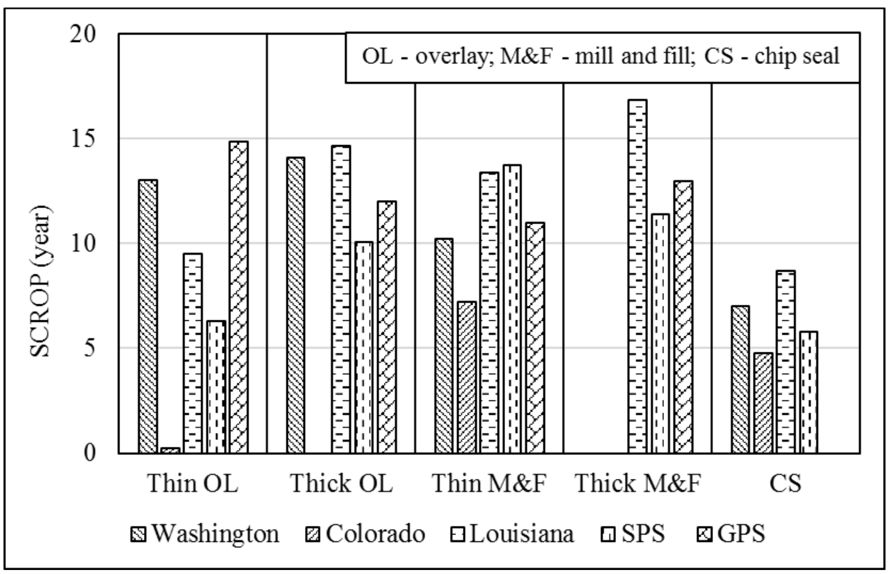


Figure 7.9 Comparison of the weighted average SCROP based on alligator cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

7.6 Longitudinal Cracking

Table 7.5 provides a summary of the average calculated benefits (based to longitudinal cracking) for all 0.1-mile-long pavement segments within each cited SHA that received the indicated treatment Examination of the three figures indicate that the benefits, in terms of the RSP, CSP, and SCROP of each treatment type of the LTPP test sections and of the 0.1-mile-long pavement For the ease of visual comparison of the benefits, they were plotted in a bar chart format as shown in Figures 7.7 through 7.9. Examination of the three figures indicate that the benefits of each treatment type of the LTPP test sections and of the 0.1-mile-long pavement segments in each of the cited SHAs are very similar.

7.7 Transverse Cracking

Table 7.6 provides a summary of the average calculated benefits (relative to transverse cracking) for all 0.1-mile-long pavement segments within each cited SHA that received the indicated treatment type and the comparable LTPP test sections. The table also lists the number of 0.1-mile-long segments and the number of LTPP test sections involved in the analyses. For the ease of visual comparison of the benefits, they were plotted in a bar chart format as shown in Figures 7.10 through 7.12. Examination of the three figures indicate that the benefits, in terms of the RSP, CSP, and SCROP of each treatment type of the LTPP test sections and of the 0.1-mile-long pavement segments in each of the cited SHAs, are very similar.

Table 7.5 Comparison of the weighted average treatment benefits based on longitudinal cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Treatment type	Data source	Longitudinal cracking			
		Number of 0.1 mile segments / test sections	RSP (year)	CSP (year)	SCROP (year)
Thin overlay	Washington	1,000	18	4	13
	Colorado	129	11	-2	1
	Louisiana	71	17	8	11
	SPS	40	13	1	5
	GPS	7	10	8	10
Thick overlay	Washington	310	19	0	14
	Louisiana	595	17	7	11
	SPS	15	14	3	4
	GPS	2	8	7	4
Thin mill and fill	Washington	357	18	4	9
	Colorado	38	9	-2	4
	Louisiana	80	18	11	12
	SPS	17	14	2	6
	GPS	22	7	5	4
Thick mill and fill	Louisiana	286	16	7	13
	SPS	15	15	4	6
	GPS	3	15	9	10
Chip seal	Washington	111	19	4	10
	Colorado	35	13	10	5
	Louisiana	772	17	9	11
	SPS	21	18	1	8

RSP = remaining structural period; CSP = change in structural period; SCROP = structural condition re-occurrence period

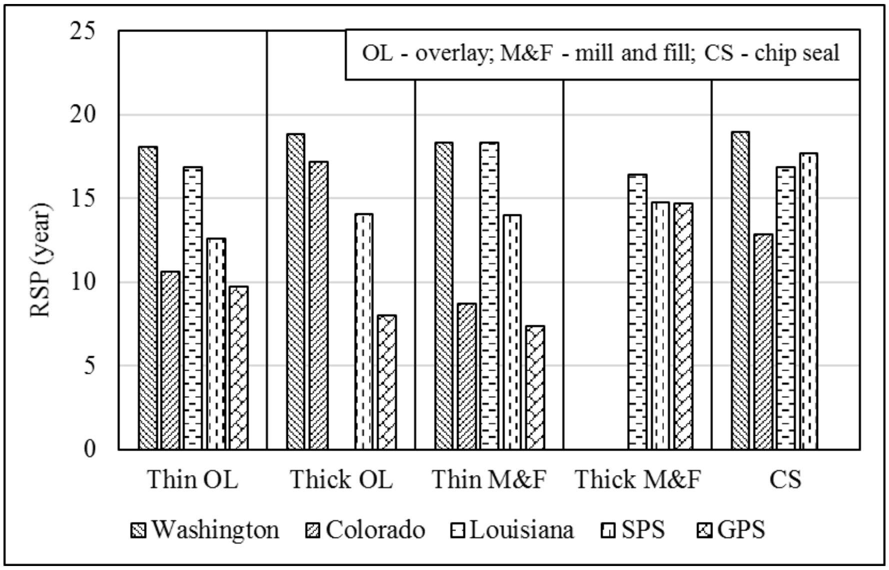


Figure 7.10 Comparison of the weighted average RSP based on longitudinal cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

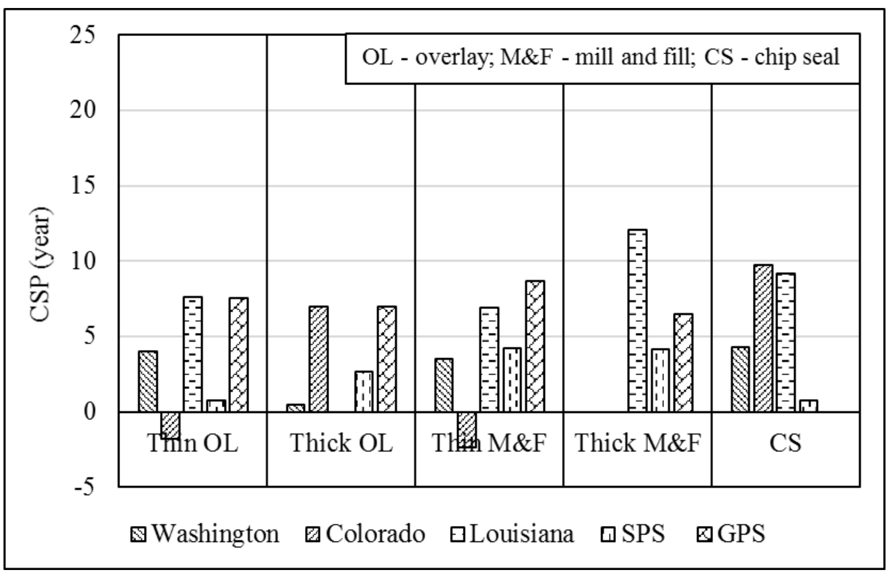


Figure 7.11 Comparison of the weighted average CSP based on longitudinal cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

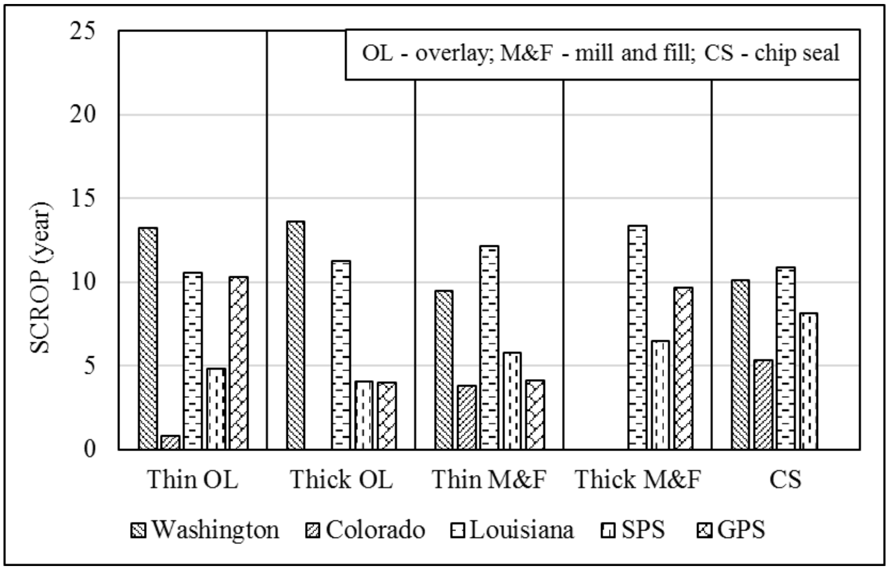


Figure 7.12 Comparison of the weighted average SCROP based on longitudinal cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

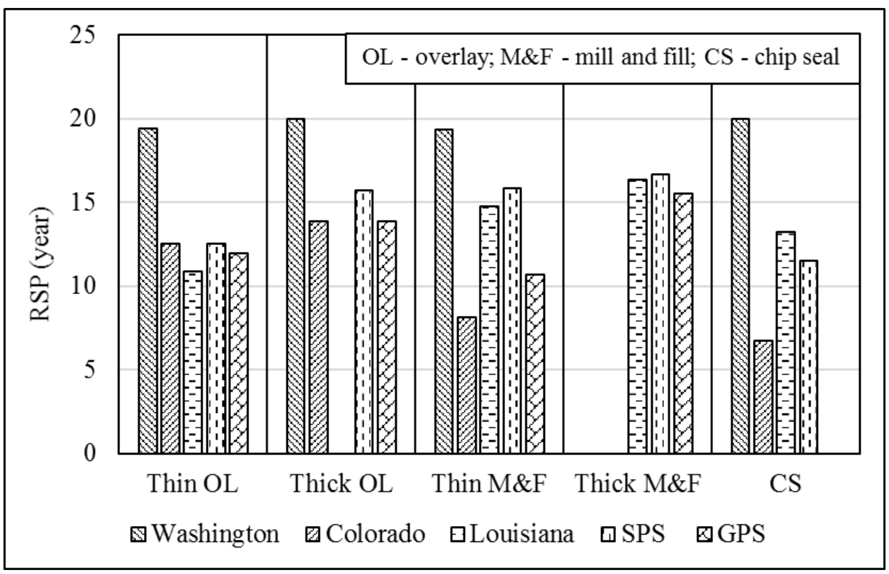


Figure 7.13 Comparison of the weighted average RSP based on transverse cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Table 7.6 Comparison of the weighted average treatment benefits based on transverse cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

Treatment type	Data source	Transverse cracking			
		Number of 0.1 mile segments / test sections	RSP (year)	CSP (year)	SCROP (year)
Thin overlay	Washington	1,538	19	2	12
	Colorado	70	13	4	4
	Louisiana	134	11	3	7
	SPS	37	13	0	7
	GPS	13	12	6	8
Thick overlay	Washington	220	20	2	17
	Louisiana	984	14	8	10
	SPS	13	16	3	11
	GPS	6	14	11	12
Thin mill and fill	Washington	633	19	2	11
	Colorado	24	8	-4	1
	Louisiana	135	15	9	12
	SPS	16	16	2	9
	GPS	6	11	5	5
Thick mill and fill	Louisiana	396	16	12	15
	SPS	14	17	4	11
	GPS	4	16	7	14
Chip seal	Washington	194	20	0	5
	Colorado	52	7	3	3
	Louisiana	819	13	9	9
	SPS	17	12	2	5
RSP = remaining structural period; CSP = change in structural period; SCROP = structural condition re-occurrence period					

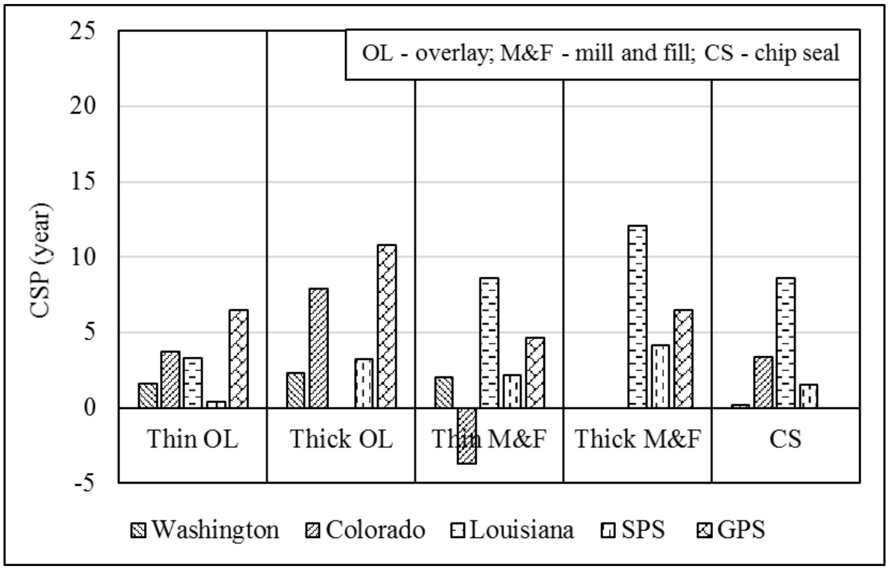


Figure 7.14 Comparison of the weighted average CSP based on transverse cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

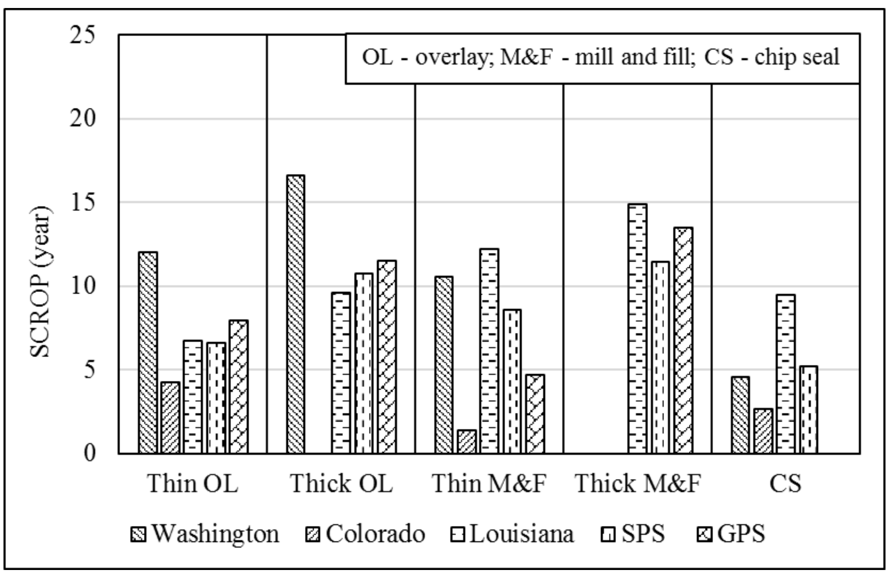


Figure 7.15 Comparison of the weighted average SCROP based on transverse cracking of five treatment types performed on LTPP test sections and on pavement projects in three SHAs

7.8 Summary, Conclusions, and Recommendations

Pavement condition and distress databases of three pavement networks were requested and received from three SHAs. Each database was searched and pavement projects that received one of the five treatment types listed below were identified.

- Thin overlay (≤ 2.5 inch)
- Thick overlay (> 2.5 inch)
- Thin mill and fill (≤ 2.5 inch)
- Thick mill and fill (> 2.5 inch)
- Single chip seal

The pavement condition and distress data for each of the 0.1-mile-long pavement segments along each selected pavement project that was treated using one of the five treatment listed above was analyzed. Results of the analyses included the RFP and RSP values before and after treatment, the CFP and CSP values after treatment, and the FCROP and SCROP values after treatment. The pavement segments of all pavement projects within one SHA that received the same treatment type were grouped based on their RFP or RSP values into the proper condition states before treatment. Each of the 0.1-mile-long pavement segments within each condition state group before treatment was listed in the after treatment condition state based on their after treatment RFP or RSP values. For each treatment type, the weighted average treatment benefits, relative to each pavement condition and distress type, were then calculated. The results are listed in Tables F.1 through F.60 of Appendix F. These weighted average treatment benefits were then compared to the weighted average treatment benefits of the LTPP test sections. The results are listed in Tables 7.2 through 7.6 and shown in Figures 7.1 through 7.15. The data in the 15 figures indicate that:

1. The weighted average benefits of each of the five treatment types, relative to each pavement condition and distress types, obtained from the analyses of the LTPP data are similar to the benefits obtained from the state data. The implication of this is that the treatment benefits provided using the LTPP data, can be used as benchmark values for the national practice. SHAs may utilize such data to:
   - Gauge the effectiveness of their current practices using similar analyses.
   - Conduct life cycle cost analyses of various treatment alternatives to optimize the pavement network rehabilitation and treatment strategy.
2. The methodologies described in previous chapters for the analyses of the LTPP pavement condition and distress data apply to the state data.
3. The three (poor, fair, and good) and the five (very poor, poor, fair, good, and very good) pavement rating systems developed and presented in Chapter 3 based on the time series pavement condition and distress, are equally applicable to the LTPP and state data.
4. The average variability in the measured pavement condition and distress data over time for the LTPP test sections is very similar to the variability of the state measured data along most pavement projects.
5. The percent of the LTPP test sections that were excluded from the analyses due to in-adequate number of data points or because of improving pavement condition and/or distress over time without the application of treatments is equivalent to the percent of the 0.1-mile-long segments of a pavement project that was excluded from the analyses for the same reasons.

Based on the results of the analyses, it is strongly recommended that:

1. The duel pavement condition rating systems be submitted for approval and adoption by the FHWA, AASHTO, and the SHAs.
2. The algorithms developed in this study be standardized and used on future research studies.
3. The benchmark values regarding the benefits of the five treatment types included in this study be expanded to include additional pavement treatments.

CHAPTER 8

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

8.1 Summary

A comprehensive review of the state-of-the-practice of various SHAs with regard to several aspects of pavement condition measures, pavement condition and distress data analyses, and treatment selection was conducted. The review also included previous related studies that were conducted using the LTPP database. The detailed literature review can be found in Chapter 2. The topics covered include:

- Pavement distress severity levels.
- Pavement condition and distress descriptions.
- Pavement performance modeling and treatment benefit calculations.
- Treatment type and time selection.
- Preservation costs and LCCA.
- The effectiveness of pavement treatments at the project and network levels.
- The LTPP program, its objectives, and the SPS and GPS test sections.
- Previous findings regarding the impacts of pavement treatments and various design factors on pavement performance.

Date required for the analyses was downloaded from the six data volumes housed in the LTPP database standard release 28.0, the data elements of the more than 2500 test sections included in the LTPP program. The data were organized in a special format and readied for analyses. In addition, the pavement management databases from three SHAs; Colorado, Washington, and Louisiana were requested and received. From each database, several pavement projects that were subjected to certain treatments in the past were identified and their data were downloaded from the respective databases and formatted for analyses.

Based on the literature review, and general review of the LTPP data, two dual pavement condition rating systems were developed based on the pavement function and its structural integrity. One system is based on three condition states (CSs), and the other is based on five CSs. For each pavement section, the functional CS is based on ride quality in term of the International Roughness Index (IRI) and safety in term of rut depth. The functional CS is expressed in term of the remaining functional period (RFP) in years for the pavement to reach the pre-specified threshold value for IRI or rut depth. The structural CS is based on the remaining structural period (RSP) in years for the pavement section to reach the threshold values relative to alligator, transverse, or longitudinal cracking or rut depth. The rating system for each CS consists of numerical classification, color coding, range of the RFP and RSP, and the average cost per 0.1 mile of preserving the pavement. Further, based on the literature review and common engineering practice, threshold value for each of IRI, rut depth, alligator, transverse, and longitudinal cracking were recommended and used in the analyses of the LTPP and state data.

The performance of each of the LTPP flexible pavement test sections included in the SPS-1, SPS-3, SPS-5, and GPS-6 experiments was analyzed. In the analyses, the available before and after treatments time series pavement condition (IRI and rut depth) and distress (rut depth, alligator, longitudinal, and transverse cracking) data were used. The data were modeled as a function of time using the proper mathematical function form (power function for rut depth, exponential for IRI, and logistic for cracking). Results of the analyses were expressed in terms of the RFP for IRI, the RFP/RSP for rut depth, and the RSP for each cracking type. Thus, for each test section, two RFP and four RSP values were calculated. These values were used to assess the impacts of regional climatic and design factors on pavement performance.

Likewise, the performance of each of the LTPP rigid pavement test sections included in the SPS-2, SPS-4, SPS-6, SPS-7, and GPS-7 experiments was analyzed. In the analyses, the available before and after treatments time series pavement condition (IRI and rut depth) and distress (rut depth, alligator, longitudinal, and transverse cracking) data were used. The intent was to study the impact of each design variable on pavement performance. When the data were divided into various groups based on separation of variables, the number of test sections under each design variable was statistically insignificant (for some variables there is only one or no test section). Therefore, the impact of the design variables on pavement performance were not analyzed or discussed any further. Rather, the data were used to study the impacts of climatic regions on pavement performance.

The pavement condition and distress databases of three pavement networks were requested and received from three State Highway Agencies (SHAs). Each database was searched and pavement projects that received one of the five treatment types listed below were identified.

- Thin overlay ($\leq$ 2.5 inch)
- Thick overlay (> 2.5 inch)
- Thin mill and fill ($\leq$ 2.5 inch)
- Thick mill and fill (> 2.5 inch)
- Single chip seal

The pavement condition and distress data measured before and after treatment of each 0.1 mile long pavement segment along each selected pavement project that was treated using one of the five treatment listed above were analyzed. The main objective of the analyses is to calculate the treatment benefits in terms of:

- The RFP and RSP values before and after treatment.
- The change in function period (CFP) and the change in structural period (CSP) due to the treatment.
- The functional condition re-occurrence period (FCROP) and the structural condition re-occurrence period (SCROP).

For each treatment type, the weighted average treatment benefits, relative to each pavement condition and distress type, were then calculated. The weighted average treatment benefits were then compared to the weighted average treatment benefits of the LTPP test sections.

8.2 Conclusions

Based on the literature review and the results of the data analyses, the following conclusions are made are presented based on topic.

8.2.1 Pavement Performance Measures

1. The pavement cracking data are typically collected and stored based on three severity levels (low, medium, and high). For most cases, the problem is that the data cannot be analyzed per severity level due to their excessive variability from one year to the next. Analyses of the cracking data based on the sum of all severity levels has been proven to overcome the problem.
2. For pavement projects received the same treatment type, treatment transition matrices (T^2Ms) can be developed to display the distribution of the pavement conditions along the project before and after treatment. The data in the T^2Ms can and were used to estimate the benefits of the various treatments.

3. Pavement condition rating should be based on current conditions and distresses as well as the pavement's rates of deterioration.
4. The three and five brackets dual pavement condition rating systems developed in this study are useful and were equally applied to both state and LTPP data. The systems are flexible and can be easily tailored to fit the needs and constraints of any road agency.
5. The estimated average cost of pavement preservation for each bracket of the dual pavement rating system can be used in the life cycle cost analyses and in strategy optimization.
6. Threshold values were provided for calculation of the RFP and RSP. The values are based on minimum level of service to the user (functional), and loss of structural integrity (structural).

8.2.2 Flexible Pavements

1. Wet-freeze (WF) region has significant adverse impacts on pavement performance in terms of IRI, rut depth, and cracking.
2. Drainable bases decrease the impacts of the WF regions on pavement performance. This conclusion was expected and support that reported in the AASHTO 1983 Pavement Design Guide.
3. Increasing the thickness of the AC layer from 4 to 7-inch increases the frost protection of the lower layers and hence, it decreases the impacts of the WF region on pavement performance. However, this option is not a cost-effective one.
4. The improvement in the pavement performance in the WF region due to drainable bases is slightly better than that due to increasing the AC thickness from 4 to 7 inch.
5. The wet-no-freeze (WNF), dry-freeze (DF), and dry-no-freeze (DNF) regions do not impact the pavement performance relative to rutting potential and IRI.

6. The DF region has more adverse effects on cracking potential than the DNF region. This is mainly attributed to higher oxidation (aging) potential of the AC layer in the DF region.
7. The inclusion of drainable bases in the DF and DNF regions does not impact pavement performance in terms of RFP or RSP. This was expected because the volume and frequency of available water are low. Further most rainfalls take place over short period of time where most water runs off the surface and does not penetrate the pavement layers.
8. The thin overlay treatment improves the pavement performance relative to IRI and rut depth in WF, WNF, and DF regions. No conclusions can be made in the DNF region because of the limited number of test sections.
9. In general, the thin overlay treatment does not improve the pavement performance of the SPS-3 test sections relative to alligator, longitudinal, and transverse cracking. This is mainly due to the high rate of reflective cracking. Immediately after treatment, all cracks are hidden by the thin overlay. However, one or few years later, most cracks are reflected through the overlay, which implies relatively high rate of deterioration and hence short RSP. The exception is in the DNF region where the two test sections showed an increase of 12 year in the average RSP relative to the one control section. This oddity is mainly due to the limited number of sections. That is, the conclusion is not reliable due to the limited number of test sections and control sections.
10. The slurry seal treatment improves the pavement performance of the SPS-3 test sections relative to IRI and rut depth but does not have much impact on alligator, longitudinal, and transverse cracking.

11. Crack sealing appears to improve the pavement performance of the SPS-3 test sections relative to rutting. However, it did not improve the pavement performance relative to cracking.
12. Aggregate seal coats appear to improve the pavement performance of the SPS-3 test sections in all climatic regions in terms of IRI, rut depth, and cracking.
13. In general, the worse are the pavement conditions before treatment, the lower are the benefits of treatments in terms of the RFP and/or RSP values.
14. On average, the impact of 2- and 4-inch virgin or recycled AC overlays on pavement performance of the SPS-5 test sections is almost the same.
15. The two inch thick AC overlay (virgin or recycled mix) does not provide a long-term remediation of transverse cracking. The cracks in the lower pavement structure typically reflect through the overlay in few years.
16. On average, the service life extension of a flexible pavement structure due to two inch AC overlay relative to alligator cracking is slightly less than the 4-inch overlay.
17. In each climatic region, the impacts of the thin and thick overlay or thin and thick mill and fill treatments on IRI and rut depths are almost the same. This was expected because good quality construction can decrease the pavement surface roughness substantially regardless of the overlay thickness and because most pavement rutting occurs early in the pavement life, which can be removed during the treatment.

8.2.3 Rigid and Composite Pavements

1. On average, the majority of the SPS-2 test sections located in the WNF region performed worse relative to longitudinal cracking than those in the DNF region. This is mainly due to the impact of excessive moisture on pavement performance.

2. The WF region has more damaging impacts on the performance of the SPS-4 test sections relative to transverse cracking than test sections located in the WNF, DF, and DNF regions. This was expected due to the combined effects of subfreezing temperatures and moisture (freeze-thaw cycles).
3. On average, relative to IRI, joint and crack sealing treatment has positive impact on the performance of the SPS-4 test sections located in the WNF region, no impact in the WF region, and negative impact in the DF and DNF regions.
4. Joint and crack sealing is effective in the WF region and not effective in the other three climatic regions. While joint undersealing is not effective in any region.
5. The performance of the treated SPS-6 test sections relative to IRI is independent of the climatic region and pavement type. Whereas, relative to rut depth, it is also independent of treatment type.
6. The alligator cracking data in the SPS-6 database are highly likely an advanced form of top down fatigue cracking (the top-down cracks are fatigue cracks initiate at the pavement surface and, over time, propagate downward). The short transverse and longitudinal cracks resemble the traditional alligator cracking pattern.
7. The performance of the test sections relative to longitudinal cracking was worse after subjecting the section to any of the seven analyzed treatment types.
8. Minimum and maximum pavement restoration with no AC overlay treatments do not improve the performance of the JRCP test sections.
9. The IRI based performance of the treated continuously reinforced concrete pavements (SPS-7) test sections is independent of the eight treatment types and the two climatic regions (WF and WNF).

10. The performance of the JPCP test sections subjected to 3-in concrete overlay with milling (703) or with shot blasting (704) treatments is lower than the performance of the other JPCP test sections subjected to the other six treatments.
11. None of the eight applied treatments are effective to treating transverse cracking problems of the CRCP test sections.

8.2.4 State Data

1. The weighted average benefits of each of five treatment types [thin overlay (≤ 2.5 inch), thick overlay (> 2.5 inch), thin mill and fill (≤ 2.5 inch), thick mill and fill (> 2.5 inch), and single chip seal] relative to each pavement condition and distress types, obtained from the analyses of the LTPP data are similar to the benefits obtained from the three state data.
2. The treatment benefits provided using the LTPP data, can be used as benchmark values for the national practice. SHAs may utilize such data to:
   a) Gauge the effectiveness of their current practices using similar analyses.
   b) Conduct life cycle cost analyses of various treatment alternatives to optimize the pavement rehabilitation and treatment strategy at the network level.
3. The methodologies described for the analyses of the LTPP pavement condition and distress data apply to the state data.
4. The three (poor, fair, and good) and the five (very poor, poor, fair, good, and very good) pavement rating systems developed in this study, and presented in Chapter 3 based on the time series pavement condition and distress, are equally applicable to the LTPP and the state data.

5. The average variability in the measured pavement condition and distress data over time for the LTPP test sections is very similar to the average variability of the state measured data along most pavement projects.
6. The percent of the LTPP test sections that were excluded from the analyses due to in-adequate number of data points or because of improving pavement condition and/or distress over time without the application of treatments is equivalent to the percent of the 0.1 mile long pavement segments of a given pavement project that was excluded from the analyses for the same reasons.

8.3 Recommendations

Based on the results of the LTPP and state data analyses and the conclusions listed above, various recommendations were drawn. For convenience, these recommendations are also listed by topics.

8.3.1 Pavement Performance Measures

Based on the results of the LTPP and state data analyses and the conclusions listed above, it is strongly recommended that:

1. The sum of crack lengths or crack areas of all severity levels be used to model the data as a function of time.
2. Accurate pavement planning and management decisions be based on the pavement conditions and rates of deterioration.
3. The three or the five brackets rating systems be adopted by the FHWA and submitted to AASHTO for approval.
4. The threshold values used in this study be either adopted or similar ones be developed by the highway owners to estimate the RFP and RSP of the various pavement sections.

5. Each highway agency develop the average cost of pavement preservation for each RFP and RSP bracket of the dual pavement rating systems using their own cost record.
6. LCCA be performed at the project level and strategy optimization at the network level to improve the overall cost-effectiveness of the pavement management application.
7. Treatment transition matrices procedure be adopted and used by the road owners to assess treatment effectiveness and to select the optimum treatment time.
8. The dual pavement rating system included in Chapter 3 be adopted for future analyses and assessment of the benefits of pavement rehabilitation and/or maintenance treatments.

8.3.2 Flexible Pavements

1. Drainable bases be constructed to enhance the performance of pavement sections located in the wet-freeze region.
2. For future studies, the control or linked test sections be selected to border the regular test sections in question and their history be included in the database. This would eliminate unnecessary variability.
3. The pavement condition and distress data be measured before and after treatments. The quality control data for project acceptance be included in the PMS database.
4. The frequency of pavement condition and distress data collection be a function of treatment type. Treatments having short treatment life should be surveyed more frequently than long life treatments.

8.3.3 State Data

1. The dual pavement condition rating systems be adopted by the FHWA, AASHTO, and the SHAs. This would unify the analyses of pavement performance.

2. The benchmark benefit values of the five treatment types included in this study be expanded to include additional pavement treatments.

APPENDICES

APPENDIX A

Inventory of Automated and Manual Surveys

APPENDIX A

Inventory of Automated and Manual Surveys

This appendix contains the Table A.s of number of automated and manual distress surveys conducted on LTPP test sections for the experiments SPS-1 to SPS-7 and GPS-6, GPS-7 and GPS-9.

Table A.1 Number of manual and automated surveys for SPS-2 test sections

State (code)	Number of manual and automated surveys for SPS-2 test sections																							
	0201		0202		0203		0204		0205		0206		0207		0208		0209		0210		0211		0212	
	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
CA (6)	11	1	11	1	11	1	10	1	11	1	11	1	11	1	11	1	11	1	11	1	11	1	11	1
DE (10)	13	4	12	4	11	4	12	4	12	4	12	4	12	4	12	4	13	4	12	4	11	4	12	4
KS (20)	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	7	11	7
NV (32)	7	6	2	1	7	6	13	6	7	6	2	1	7	6	7	6	8	6	8	6	7	6	-	-
NC (37)	19	4	6	4	12	5	11	5	6	4	6	4	11	5	12	5	10	4	6	4	11	5	12	5
OH (39)	7	6	7	6	10	6	8	6	7	6	6	6	9	6	7	6	8	6	7	6	10	6	8	6
WA (53)	16	3	16	3	16	3	16	3	16	3	16	3	16	3	16	3	16	3	16	3	16	3	16	3
	Number of manual and automated surveys for SPS-2 test sections																							
	0213		0214		0215		0216		0217		0218		0219		0220		0221		0222		0223		0224	
AZ (4)	12	5	11	5	26	5	12	5	12	5	12	5	12	5	12	5	12	5	12	5	12	5	12	5
AR (5)	7	3	10	3	10	3	10	3	10	3	10	3	10	3	10	3	10	3	10	3	10	3	10	3
CO (8)	12	6	12	6	12	6	12	6	14	7	14	7	14	7	14	7	14	7	14	7	14	7	14	7
IA (19)	10	6	9	6	10	6	10	6	10	6	10	6	10	6	10	6	10	6	9	6	10	6	9	6
MI (26)	5	2	6	6	5	2	14	6	4	1	3	1	13	6	14	6	15	6	11	6	14	6	14	6
ND (38)	10	6	9	6	9	6	9	6	10	6	9	6	9	6	9	6	10	6	9	6	9	6	9	6
WI (55)	7	5	7	5	7	5	7	5	7	5	7	5	7	5	7	5	7	5	7	5	7	5	7	5

Table A.2 Number of manual and automated surveys for SPS-3 test sections

State (code)	Site	Thin overlay		Slurry seal		Crack seal		Control section		Chip seal	
		Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
AL (1)	A300	6	2	6	2	6	2	5	2	6	2
	B300	5	2	5	2	5	2	5	2	5	2
	C300	8	2	8	2	8	2	8	2	5	2
AZ (4)	A300	3	-	3	-	3	-	3	-	3	-
	B300	-	-	1	-	1	-	5	-	1	-
	C300	4	-	2	-	3	-	3	-	4	-
	D300	3	-	1	-	2	-	5	-	1	-
AR (5)	A300	8	2	8	2	-	-	8	-	8	2
CA (6)	A300	6	1	7	1	7	1	7	1	7	1
CO (8)	A300	2	-	2	-	2	-	2	-	2	-
	B300	2	-	2	-	2	-	3	-	2	-
FL (12)	A300	6	2	6	2	6	2	6	-	6	2
	B300	4	2	4	2	4	2	6	-	4	2
	C300	7	2	6	2	6	2	6	-	6	2
ID (16)	A300	5	-	5	-	5	-	6	-	5	-
	B300	6	-	6	-	6	-	7	-	6	-
	C300	4	-	4	-	4	-		-	4	-
IL (17)	A300	8	2	8	2	8	2	8	2	8	2
	B300	8	2	7	2	7	2	7	2	7	2
IN (18)	A300	6	2	7	2	6	2	6	2	6	2
IA (19)	A300	4	-	4	-	4	-	4	-	4	-
KS (20)	A300	6	1	6	1	6	1	5	1	6	1
	B300	6	1	6	1	6	1	6	1	6	1
KY (21)	A300	4	2	4	2	5	2	4	2	4	2
	B300	6	2	6	2	5	2	4	2	4	2
MD (24)	B300	7	-	7	-	7	-	7	-	7	-
MI (26)	A300	4	1	5	1	5	1	5	1	4	1
	B300	5	1	5	1	5	1	5	1	5	1
	C300	5	1	5	1	5	1	5	1	5	1
	D300	5	1	5	1	5	1	5	1	5	1
MN (27)	A300	3	-	3	-	3	1	3	1	3	1
	B300	4	1	4	1	4	1	4	1	4	1
	C300	4	1	3	1	3	1	3	1	2	1
	D300	4	1	3	1	1	1	3	1	4	1
MS (28)	A300	5	-	5	-	5	-	13	-	5	-
MO (29)	A300	8	1	8	1	8	1	8	1	8	1
	B300	8	1	7	1	7	1	7	1	7	1
MT (30)	A300	5	-	5	-	5	-	5	-	5	-
NE (31)	A300	5	-	6	-	6	-	6	-	6	-
NV (32)	A300	4	-	3	-	3	-	3	-	4	-
	B300	3	-	3	-	3	-	3	-	3	-
	C300	2	-	2	-	2	-	4	-	2	-

Table A.2 (cont'd)

State (code)	Site	Number of manual and automated surveys for SPS-3 test sections									
		Thin overlay		Slurry seal		Crack seal		Control section		Chip seal	
		Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
NY (36)	A300	7	-	7	-	7	-	7	-	7	-
	B300	6	-	6	-	6	-	6	-	6	-
OK (40)	A300	-	-	5	1	5	1	5	1	5	1
	B300	6	1	6	2	6	2	7	-	6	1
PA (42)	A300	7	-	7	-	7	-	7	-	7	-
	B300	6	-	-	-	7	-	6	-	7	-
TN (47)	A300	3	2	3	2	3	2	10	-	1	2
	B300	4	2	4	2	4	2	6	-	4	2
	C300	4	1	4	1	4	1	9	-	4	1
TX (48)	A300	7	-	7	-	7	-	7	-	-	-
	B300	9	4	9	4	9	4	8	4	9	4
	D300	5	1	5	1	4	1	5	1	5	1
	E300	5	3	4	3	5	3	6	3	4	3
	F300	7	2	6	2	6	2	5	2	5	2
	G300	6	1	6	1	6	1	7		5	1
	H300	5	1	5	1	5	1	5	1	5	1
	I300	6	1	7	1	7	1	7	1	7	1
	J300	9	-	9	-	9	-	9	-	9	-
	K300	9	-	9	-	9	-	9	-	9	-
	L300	8	1	8	1	8	1	8	1	8	1
	M300	8	-	8	-	8	-	8	-	8	-
	N300	5	-	5	-	5	-	5	-	5	-
	Q300	8	-	8	-	8	-	8	-	8	-
UT (49)	A300	4	-	4	-	4	-	5	-	4	-
	B300	6		2	-	6	-	5	-	6	-
	C300	6	1	6	1	6	1	6	-	6	1
VA (51)	A300	7	-	7	-	7	-	7	-	7	-
WA (53)	A300	2	-	2	-	2	-	7	-	2	-
	B300	5	-	5	-	5	-	5	-	5	-
	C300	4	-	4	-	5	-	4	-	5	-
WY (56)	A300	3	-	3	-	3	-	20	-	3	-
	B300	6	-	6	-	6	-	8	-	6	-
MB (83)	A300	7	1	7	1	7	1	8	1	7	1
ON (87)	A300	4	-	4	-	4	-	4	-	4	-
	B300	6	-	6	-	6	-	6	-	-	-
PQ (89)	A300	6	-	6	-	6	-	6	-	6	-
SK (90)	A300	5	1	6	1	4	1	6	1	7	1
	B300	5	1	6	1	6	1	6	-	6	1

Table A.3 Number of manual and automated surveys for SPS-4 test sections

State (code)	Site	410		420		430	
		Manual	Automated	Manual	Automated	Manual	Automated
AZ (4)	A400	4	3	-	-	4	2
AK (5)	A400	4	1	-	-	4	1
	B400	3	2	-	-	3	2
	C400	3	2	-	-	3	2
CA (6)	A400	5	3	4	3	5	3
	B400	5	-	5	-	5	-
CO (8)	A400	4	2	-	-	4	2
IN (18)	A400	5	1	-	-	5	1
IA (19)	A400	1	1	-	-	1	1
	B400	2	-	-	-	2	-
KS (20)	A400	2	2	-	-	2	2
	B400	2	1	-	-	2	1
KY (21)	A400	3	1	-	-	3	-
MS (28)	A400	4	-	-	-	4	-
MO (29)	A400	3	-	-	-	3	-
	B400	4	2	-	-	4	2
NE (31)	A400	4	3	-	-	4	3
	B400	4	3	-	-	4	3
	C400	4	1	-	-	4	1
NV (32)	A400	3	1	4	1	3	1
OH (39)	A400	4	1	-	-	4	1
	B400	3	1	-	-	3	1
OK (40)	A400	5	3	5	3	5	2
PA (42)	A400	5	-	-	-	5	-
	C400	6	1	-	-	6	1
SD (46)	A400	5	1	4	1	4	1
TX (48)	A400	4	2	4	2	4	2
	B400	8	1	8	1	8	1
	C400	7	1	7	1	7	1
	D400	7	1	7	1	7	1
	E400	7	2	7	2	7	2
UT (49)	C400	6	-	-	-	6	-
	D400	4	-	-	-	4	-

Table A.4 Number of manual and automated surveys for SPS-5 test sections

State (code)	Number of manual and automated surveys for SPS-5 test sections																	
	501		502		503		504		505		506		507		508		509	
	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
AL (1)	7	-	14	5	14	5	14	5	14	5	14	5	14	5	14	5	14	5
AZ (4)	2	5	11	8	11	8	11	8	12	8	12	8	11	8	11	8	12	8
CA (6)	11	9	11	9	11	9	11	9	11	9	11	9	11	9	11	9	11	9
CO (8)	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6
FL (12)	10	-	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4
GA (13)	-	-	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
ME (23)	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4	9	4
MD (24)	10	6	13	7	13	7	12	7	12	7	12	7	12	7	13	7	12	7
MN (27)	11	8	11	8	9	7	12	8	11	8	12	8	12	8	11	8	11	8
MS (28)	4	4	4	5	4	4	4	5	4	5	4	4	4	5	4	5	4	4
MO (29)	4	2	7	3	7	3	7	3	7	3	8	3	8	3	8	3	8	3
MT (30)	7	-	8	6	9	6	9	6	9	6	9	6	9	6	9	6	8	6
NJ (34)	9	8	11	8	12	8	11	8	12	8	11	8	12	8	12	8	11	8
NM (35)	6	3	9	4	9	4	9	4	9	4	9	4	9	4	9	4	8	4
OK (40)	9	3	10	4	10	4	10	4	10	4	10	4	10	4	10	4	10	4
AB (81)	12	6	12	4	12	4	12	6	12	6	12	6	12	6	12	6	12	6
MB (83)	6	4	12	6	12	6	12	6	12	6	12	6	11	6	12	6	11	6

Table A.5 Number of manual and automated surveys for SPS-6 test sections

State (code)	Number of manual and automated surveys and treatments for SPS-6 test sections															
	601		602		603		604		605		606		607		608	
	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
AL (1)	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3
AZ (4)	1	2	1	2	7	7	7	6	2	2	7	6	7	6	7	6
AK (5)	10	3	10	3	10	3	11	3	10	3	10	3	10	3	10	3
CA (6)	-	-	10	8	11	6	11	6	8	8	11	6	11	6	11	6
IL (17)	10	6	10	5	11	6	11	6	10	6	11	6	11	6	11	6
IN (18)	2	3	9	8	10	7	11	7	8	8	10	7	11	7	10	7
IA (19)	6	10	6	10	8	10	8	10	8	10	10	10	11	10	10	10
MI (26)	3	4	3	4	4	4	4	4	6	4	8	4	9	4	10	4
MO (29)	6	4	6	4	9	4	9	5	3	4	4	5	4	2	4	5
OK (40)	13	6	13	6	13	4	13	4	13	6	13	4	13	5	13	5
PA (42)	11	6	11	6	11	5	11	5	11	6	11	5	11	5	11	5
SD (46)	10	7	9	7	9	6	9	6	9	7	9	6	9	6	9	6
TN (47)	8	4	8	4	8	3	8	3	8	4	8	3	6	2	8	3

Table A.6 Number of manual and automated surveys for SPS-7 test sections

State (code)	Number of manual and automated surveys and treatments for test sections in SPS-7																	
	0701		0702		0703		0704		0705		0706		0707		0708		0709	
	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Automated
IA (19)	2	-	4	-	4	-	5	-	5	-	5	-	5	-	4	-	4	-
LA (22)	-	-	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4	-
MS (28)	3	-	5	-	5	-	5	-	4	-	4	-	4	-	4	-	3	-
MO (29)	7	7	7	7	7	7	7	7	7	7	5	5	6	5	7	7	7	7

Table A.7 Number of manual and automated surveys for GPS-6 test sections

State (code)	SHRP ID	No of surveys		State (code)	SHRP ID	No of surveys		State (code)	SHRP ID	No of surveys	
		Manual	Automated			Manual	Automated			Manual	Automated
AL (1)	6012	7	4	CA (6)	6044	1	3	FL (12)	4101	1	5
	6019	5	5		2038	8	6		4135	5	7
	1001	5	7		2041	8	6		4136	5	6
	4127	4	7		2051	5	7		4137	5	6
	4129	3	5		7452	9	6		4096	9	8
	1019	6	6		8150	9	6		1370	9	8
	4155	9	6		8153	10	7		3997	6	5
AZ (4)	6053	1	5		8202	6	6		4100	8	8
	6054	2	6		8534	10	6		4106	7	7
	6055	3	6		8535	10	6	GA (13)	4420	8	8
	6060	4	7		2002	9	5		4096	8	7
	1002	2	5		7454	6	6		4112	6	6
	1003	7	9		7491	9	7		4113	6	6
	1006	8	9		8149	10	6	ID (16)	6027		4
	1007	8	7	CO (8)	6002	6	7		1001	7	8
	1015	6	8		6013	4	6		1007	7	8
	1016	6	6		7780	8	5	IL (17)	6050	1	5
	1017	9	6		7783	8	6	IN (18)	6012	9	6
	1018	8	8		1047	2	4		1037	9	7
	1021	7	6		7781	7	6		2008	8	6
	1022	10	7		1053	19	6		1028	10	4
	1024	17	7		1029	9	6	IA (19)	6049	3	6
	1025	13	6	CT (9)	1803	13	7		6150	7	5
AK (5)	3058	7	7	DE (10)	1450	8	6		0107	7	7
	2042	7	8	DC (11)	1400	1	3		1044	8	7

Table A.7 (cont'd)

State (code)	SHRP ID	No of surveys		State (code)	SHRP ID	No of surveys		State (code)	SHRP ID	No of surveys	
		Manual	Automated			Manual	Automated			Manual	Automated
KS (20)	1006	2	6	MS (28)	3081	5	7	NM (35)	6033	11	5
	6026	9	8		3091	4	6		6035	2	5
	1005	9	6		3093	4	7		6401	4	5
	1009	8	7	MO (29)	6067	1	5		2118	9	6
KY (21)	6040		3		5403	4	8	NY (36)	1008	3	6
	6043	2	5		5413	4	8		1011	4	7
	1034	7	8		1010	3	6		1643	7	7
ME (23)	1009	5	8	MT (30)	6004	8	5		1644	7	7
	1026	7	7		7075	9	5	NC (37)	1040	5	5
	1028	9	8		7066	9	7		1645	9	6
	1001	4	6		7076	9	6		1802	6	6
MD (24)	1634	13	6		7088	9	7		1352	7	6
	2805	6	7		8129	18	7		1817	7	5
MA (25)	1004	7	7	NE (31)	6700	3	7		1992	8	5
MI (26)	6016	1	5	NV (32)	1030	1	4		2819	8	6
MN (27)	6064	3	6		1020	9	8		2824	8	6
	1016	4	8	NH (33)	1001	12	7		1803	6	8
	1018	13	7	NJ (34)	6057	3	5		1006	8	6
	1023	6	9		1003	4	6		1024	4	6
	1028	10	6		1011	5	7		1028	11	6
	6251	18	7		1030	5	6		1801	7	6
MS(28)	3094	5	7		1031	5	7		1814	7	6
	3087	9	8		1033	8	7		2825	6	6
	1001	5	7	NM (35)	1002	5	5	OH (39)	111	13	6
	2807	4	5		2007	3	3	OK (40)	6010	5	5

Table A.7 (cont'd)

State (code)	SHRP ID	No of surveys Manual	No of surveys Automated	State (code)	SHRP ID	No of surveys Manual	No of surveys Automated	State (code)	SHRP ID	No of surveys Manual	No of surveys Automated
OK (40)	4086	9	7	TN (47)	1029	8	6	TX (48)	1068	14	7
	4154	11	6		3101	10	6		2108	11	7
	4164	7	7		3110	7	7		2176	10	6
	4087	7	6		9025	8	6		3769	9	8
	4163	9	8	TX (48)	1046	8	6	UT (49)	1004	4	5
OR (41)	6011	2	4		6079	6	5		1005	1	4
	6012	-	1		6086	6	5		1006	6	8
	2002	8	6		6160	2	3		1007	1	4
PA (42)	1608	6	6		6179	6	6	VT (50)	1681	5	8
	1605	8	5		1039	9	8		1683	7	8
	1618	3	6		1092	12	7		1004	14	7
	1599	7	8		1093	9	7	VA (51)	1002	6	6
	1597	10	7		1096	10	6		1417	8	7
SC (45)	1025	4	4		1111	11	7		1419	9	7
SD (46)	9106	5	7		1113	7	7		1423	7	6
	9197	4	6		1116	5	5		2021	3	4
TN (47)	6015	4	4		1119	7	6		2004	10	6
	6022	1	3		1130	9	7		1023	9	6
	1023	9	7		3669	10	6		1464	6	7
	1028	8	5		3729	9	7	WA (53)	6020	5	6
	2001	9	6		3835	10	5		6048	3	4
	2008	8	6		3855	10	7		6049	2	3
	3108	7	7		3875	7	6		6056	8	6
	3109	8	7		9005	14	6		7322	6	5
	9024	8	6		3865	14	7		1005	9	7

Table A.7 (cont'd)

State (code)	SHRP ID	No of surveys		State (code)	SHRP ID	No of surveys	
		Manual	Automated			Manual	Automated
WA (53)	1007	10	7	MB (83)	6451	7	7
	1008	7	8		6454	7	6
WV (54)	1640	5	6	NB (84)	6804	5	7
WY (56)	6029	6	6		1684	10	5
	6031	7	6	NS (86)	6802	5	7
	6032	5	5	ON (87)	1680	8	7
	2017	10	5		1806	6	7
	2019	8	6		1620	5	7
	7772	9	6		1622	12	7
	7775	12	7	PQ (89)	1021	10	4
	2020	10	6		1125	5	6
AB (81)	8529	10	5		1127	5	7
	1804	10	5	SK (90)	6400	4	7
	1805	10	6		6801	4	7
BC (82)	6006	8	6		6405	14	6
	6007	11	6		6410	4	7
	1005	7	6		6412	4	7
MB (83)	6450	7	6		6420	8	6

Table A.8 Number of manual and automated surveys for GPS-7 test sections

State (code)	SHRP ID	No of surveys		State(code)	SHRP ID	No of surveys		State(code)	SHRP ID	No of surveys		State(code)	SHRP ID	No of surveys	
		Manual	Automated			Manual	Automated			Manual	Automated			Manual	Automated
AL (1)	3998	2	5	IN (18)	5528	6	6	NE (31)	7017	5	1	PA (42)	1617	3	3
CA (6)	7455	2	5		5538	7	6		7040	5	2		1627	8	5
	7456	2	3	IA (19)	3006	6	9		7050	4	6		1691	6	6
CO (8)	7035	7	8		3055	7	6		3024	8	6		1606	7	15
	7036	4	1		9116	6	5		4019	5	8		1623	7	5
CT (9)	4020	5	7		9126	7	2		6702	6	2	RI (44)	7401	7	7
	5001	1	6	KS (20)	7073	5	3	NC (37)	5826	4	4	SC (45)	7019	3	2
DE (10)	4002	6	4		7085	6	1		5827	-	1	SD (46)	7049	6	3
	5005	1	7		4067	4	1		3008	5	8	TX (48)	3629	5	4
GA (13)	7028	7	8		3013	7	7	OH (39)	7021	7	2		7165	3	5
ID (16)	5025	1	5	ME (23)	7023	6	3		3013	7	8		5287	1	5
IL (17)	5423	4	4	MI (26)	7072	5	1		5010	6	4		5154	1	5
	5453	6	4	MN (27)	7090	4	-		4018	7	11		5274	2	5
	7937	7	4		5076	5	1		5003	-	1	VT (50)	1682	6	7
	5151	7	7	MS (28)	3097	4	2	OK (40)	7024	5	4	VA (51)	2564	-	1
	5217	3	1		7012	6	6	OR (41)	7018	6	4	WA (53)	3813	7	13
	5849	2	3		3099	2	3		7019	4	2	WV (54)	7008	4	2
	5854	1	3		5803	-	-		7025	4	1		4004	5	7
	9267	1	6	MO (29)	7054	8	3		5006	-	4		5007	2	2
	9327	3	2		7073	5	2		5008	-	4	MB (83)	3802	6	11
	5843	6	5		4069	7	2	PA (42)	1610	7	3		6452	7	1
IN (18)	3003	8	7		5393	6	-		7025	3	1	ON (87)	2811	7	4
	5022	4	6		5473	6	3		7037	6	2		2812	5	1
	5043	-	4		5483	5	3		1613	4	3	PQ (89)	3001	-	5
	5518	4	5	NE (31)	7005	5	4		1614	7	5		3015	6	15

Table A.9 Number of manual and automated surveys for GPS-9 test sections

State(code)	SHRP ID	No of surveys	
		Manual	Automated
CA (6)	9048	5	8
	9049	3	4
	9107	5	4
CO (8)	9019	7	1
	9020	6	1
GA (13)	4118	-	-
IN (18)	9020	5	4
KS (20)	9037	5	1
MI (26)	9029	6	4
	9030	5	2
MN (27)	6300	5	3
	9075	5	1
MS (28)	9030	7	2
NE (31)	6701	5	3
OH (39)	5569	5	5
	9006	7	6
	9022	5	6
OK (40)	4155	-	-
PA (42)	9027	6	9
TX (48)	3569	-	-
	3845	-	-
	9167	7	8
	9355	7	8
PQ (89)	9018	7	5

APPENDIX B

Summary of the LTPP Data

APPENDIX B

Summary of the LTPP Data

This appendix houses summary Table B.s regarding the LTPP data. In all Table B.s the alphabetically labeled columns list the following information:

- ✓ Column A – The climatic Zone.
- ✓ Column B – The State.
- ✓ Column C – Treatment type.
- ✓ Column D – The number of SPS-1 test sections.
- ✓ Column E – The number of times the treatment type was applied. When the number in column E is higher than the number in column D, it implies that one test section received the treatment more than one time.
- ✓ Column F – The number of treatment applications where three or more time series data points are available before and after treatment.
- ✓ Column G – The number of treatment applications where 3 or more time series data points are available before treatment only.
- ✓ Column H – The number of treatment applications where 3 or more time series data points are available after treatment only.
- ✓ Column I - The number of treatment applications where one data point can be assigned (assumed), (see note below), which make 3 time series data points before and after treatment.
- ✓ Column J – The number of treatment applications where one data point can be assigned (assumed), (see note below), which make 3 time series data points before treatment only.
- ✓ Column K – The number of treatment applications where one data point can be assigned (assumed), (see note below), which make 3 time series data points after treatment only.
- ✓ Column L – The number of SPS-1 test sections that have three or more time series data points and can be analyzed before and after treatment.
- ✓ Column M – The number of SPS-1 test sections that have three or more time series data points and can be analyzed before treatment only.
- ✓ Column N – The number of SPS-1 test sections that have three or more time series data points and can be analyzed after treatment only.

Table B.1 Summary of cracking data for SPS-1 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	KS (20)	CS	6	6	0	7	0	0	0	0	0	7	0
		CS-STP	1	1	0	1	0	0	0	0	0	1	0
		MOAC	9	9	0	2	0	0	0	8	2	0	6
		PP	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	ASC	12	12	0	1	0	0	0	0	0	1	0
		CS	12	36	1	11	12	0	0	0	1	11	12
	NE (31)	GS	11	11	1	0	0	0	12	0	1	12	0
	NV (32)	CS	7	7	6	0	1	0	0	0	6	0	1
		FDP	1	1	1	0	0	0	0	0	1	0	0
		PPH	6	7	1	5	0	0	0	0	1	5	0
		SP	1	1	0	1	0	0	0	0	0	1	0

Table B.1 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	1	0	0	0	0	0	1
	AR (5)	CS	8	8	0	8	0	0	0	0	0	8	0
		FDP	2	2	0	2	0	0	0	0	0	2	0
		MPSP	3	3	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	2	0	0	0	0	0	2
		CS-MPSP	1	1	0	1	0	0	0	0	0	1	0
		CS-PPH	0	1	0	1	0	0	0	0	0	1	0
Wet -freeze	DE (10)	ACOL	12	12	0	0	12	0	0	0	0	0	12
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	IA (19)	STP	12	12	11	0	1	0	1	0	12	0	0
	OH (39)	CS	1	1	0	0	0	0	0	0	0	0	0
		HMACR	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	0	0	1	0	0	1	0
		SR-MOAC	1	1	0	1	0	0	0	0	0	1	0
	MI (26)	CS	8	15	0	0	7	0	0	0	0	7	0
		CS-PPH	1	1	0	1	0	0	0	0	0	1	0
		MOAC	8	8	0	5	0	0	3	0	0	8	0
		SR-MOAC	8	8	0	8	0	0	0	0	0	8	0
	VA (51)	STP	12	12	11	1	0	0	0	0	11	1	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		ACOL	11	11	0	11	0	0	0	0	0	11	0

Table B.2 Summary of cracking data for SPS-2 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-No-freeze	AZ (4)	PDPJ	2	2	1	1	0	0	0	0	1	1	0
		PDPJ-PDPOJ	3	3	1	1	1	0	0	0	1	1	1
	CA (6)	GS	1	1	0	0	1	0	0	0	0	0	1
		LSLJS	6	6	2	2	2	0	0	0	2	2	2
		LSLJS-TJS	7	10	2	1	6	0	0	0	2	1	6
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PDPJ	5	8	3	2	2	0	0	1	4	2	1
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
	NV (32)	CS	6	10	0	1	5	0	0	0	0	1	5
		FDPOJ	1	4	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	1	0	1	0	1	0	0
		PDPOJ	3	6	0	1	1	0	0	0	0	1	1
		CS-PDPJ	2	2	0	0	1	0	0	0	0	0	1
		CS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	AR (5)	CS	1	1	0	1	0	0	0	0	0	1	0
		CS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS	1	1	0	1	0	0	0	0	0	1	0
		LSLJS	12	12	0	0	11	0	0	0	0	11	0
		PDPJ	3	4	0	0	2	0	0	0	0	0	2
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	2	0	0	0	0	0	2	0	0
	NC (37)	PDPJ	1	1	0	0	1	0	0	0	0	0	1

Table B.2 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet -freeze	DE (10)	CS/OTHER	1	1	0	1	0	0	0	0	0	1	0
		CS/PPH	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP	2	2	0	0	2	0	0	0	0	0	2
		GS	7	7	6	1	0	0	0	1	7	0	0
		LSLJS	2	2	0	2	0	0	0	0	0	2	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	IA (19)	TJS-LSLJS-SR	1	1	0	0	1	0	0	0	0	0	1
		SR	1	1	0	1	0	0	0	0	0	1	0
	KS (20)	FDTJRP	5	5	0	4	0	0	0	0	0	4	0
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	4	6	0	1	0	0	0	0	0	1	0
		PDPJ-SR	1	1	0	0	1	0	0	0	0	0	1
		SR	1	2	0	1	0	0	0	0	0	1	0
		TJS	3	3	2	0	1	0	0	0	2	0	1
		TJS-LSLJS	9	9	7	2	0	0	0	0	7	2	0
	OH (39)	OTHER	3	3	0	3	0	0	0	0	0	3	0
	MI (26)	ACSR	1	2	0	1	0	0	0	0	0	1	0
		LSLJS	7	7	6	1	0	0	0	0	6	1	0
		PDPJ	5	6	4	0	0	0	0	0	4	0	0
		SR	1	1	0	0	0	0	0	0	0	0	0

Table B.3 Summary of cracking data for SPS-3 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry- no-freeze	AZ (4)	ACOL	4	4	0	0	1	0	0	0	0	0	1
		ASC	4	4	0	0	2	0	0	0	0	0	2
		CS	4	5	0	0	1	0	0	0	0	0	1
		MPP	4	4	0	0	2	0	0	0	0	0	2
		MPSP	2	2	0	0	0	0	0	0	0	0	0
		SS	4	4	0	0	1	0	0	0	0	0	1
	OK (40)	ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	ACOL	8	8	0	0	8	0	0	0	0	0	8
		ASC	8	8	0	0	6	0	0	0	0	0	6
		CS	16	18	0	5	1	0	0	0	0	5	1
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		CS-SP	2	2	0	0	0	0	0	0	0	0	0
		FDPAC	5	6	0	4	0	0	0	0	0	4	0
		FSC	1	1	0	0	1	0	0	0	0	0	1
		SP	7	16	0	1	0	0	0	0	0	1	0
		SS	8	8	0	0	6	0	0	0	0	0	6

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA(6)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	7	0	5	1	0	0	0	0	5	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	CO(8)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	2	2	0	0	0	0	0	1	0	0	1
		CS	2	3	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
		SS	2	2	0	0	0	0	0	2	0	0	2
		STSL	1	1	0	0	0	0	0	0	0	0	0
	ID(16)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	3	0	0	0	0	0	3
		SS	3	3	0	0	3	0	0	0	0	0	3
	KS(20)	ACOL	2	2	0	0	1	0	0	1	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	6	8	0	6	2	0	0	0	0	6	2
		FDACP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	0	1	0	0	1	0	0	1
	MT(30)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	NE (31)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	4	5	0	4	1	0	0	0	0	4	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	NV (32)	ACOL	3	3	0	0	2	0	0	1	0	0	3
		ASC	3	3	0	0	1	0	0	1	0	0	2
		CS	3	3	0	0	1	0	0	0	0	0	1
		MPSP	4	6	0	0	1	0	0	0	0	0	1
		SS	3	3	0	0	0	0	0	1	0	0	1
	UT (49)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	4	5	0	2	3	0	0	0	0	2	3
		SS	2	2	0	0	2	0	0	0	0	0	2
	WA (53)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	3	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	WY (56)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	SK (90)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		FDPAC	2	3	1	1	0	0	0	0	1	1	0
		MPSP	3	7	0	1	0	0	0	0	0	1	0
		MPSP-ASC	1	1	0	0	0	0	0	0	0	0	0
		PPH	4	4	0	3	0	0	0	0	0	3	0
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet -no-freeze	AL (1)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	5	6	0	4	1	0	0	0	0	4	1
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	10	0	3	0	0	0	0	0	3	0
		SS	3	3	0	0	3	0	0	0	0	0	3
	AR (5)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	1	0	0	0	0	0	1
		PPH	2	5	0	2	0	0	0	0	0	2	0
		SS	3	3	0	0	2	0	0	1	0	0	3
	OK (40)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	1	0	0	1	0	0	2
		CS	2	3	0	1	2	0	0	0	0	1	2
		MPP	3	4	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	1	0	0	1	0
		SS	2	2	0	0	1	0	0	1	0	0	2

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet -no-freeze	TN (47)	ACOL	3	3	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	4	8	0	0	1	0	0	0	0	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	0	0	1	0	0	1	0
		SS	1	2	0	0	1	0	0	1	0	0	2
		SS-CS	1	1	0	0	1	0	0	0	0	0	1
		ASC-CS	1	1	0	0	0	0	0	1	0	0	1
	TX (48)	ACOL	6	6	0	0	6	0	0	0	0	0	6
		SS	5	5	0	0	5	0	0	0	0	0	5
		ASC	5	5	0	0	3	0	0	1	0	0	4
		MPSP	4	4	0	3	0	0	0	0	0	3	0
		CS	6	8	0	0	3	0	0	0	0	0	3
		MPP	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	1	0	0	0	0	0	1	0
		CS-SS	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	2	0	0	0	0	0	0	0	0	0
		ASCR	4	4	0	4	0	0	0	0	0	4	0

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet - freeze	IL (17)	ACOL	2	2	0	0	0	0	2	0	1	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	3	4	1	0	3	0	0	0	1	0	3
		LS-LJS	2	3	2	0	1	0	0	0	2	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	2	0	0	0	0	0	2
	IN (18)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	KY (21)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-CS	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet -freeze	MI (26)	ACOL	4	4	0	0	4	0	0	0	0	0	4
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	6	6	0	0	4	0	0	0	0	0	4
		MPSP	3	4	0	2	0	0	0	0	0	2	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		SS	4	4	0	0	4	0	0	0	0	0	4
	MN (27)	ACOL	3	3	0	0	2	0	0	1	0	0	3
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	5	5	0	0	3	0	0	0	0	0	3
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	0	0	0	0	0	0	0	0
		SS	4	4	0	0	4	0	0	0	0	0	4
	MO (29)	ACOL	2	2	0	0	1	0	0	1	0	0	2
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	6	0	4	2	0	0	0	0	4	2
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		CS-STP	5	5	0	3	0	0	0	0	0	3	0
		CS-STP-SP	3	3	0	0	0	0	0	0	0	0	0
		MPSP	3	6	1	0	0	0	0	0	1	0	0
		SS	2	2	0	0	2	0	0	0	0	0	2
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	0	0	0	0	0	0	0
		MPP	2	2	0	0	0	0	0	0	0	0	0
		MPSP	3	3	0	3	0	0	0	0	0	3	0
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		MPSP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	6	4	0	0	1	0	0	0	0	0	1
		SS	2	2	0	0	0	0	0	0	0	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0

Table B.3 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ASCR	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	3	5	0	0	1	0	0	0	0	0	1
		CS-MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	2	2	1	0	1	0	0	0	1	0	1
	ON (87)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	3	3	0	0	2	0	0	0	0	0	2
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	1	0	0	0	0	0	1
	PQ (89)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	0	0	0	0	0	0	0

Table B.4 Summary of cracking data for SPS 4 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	CA (6)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
		FDPOJ	1	3	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	3	8	0	1	0	0	0	0	0	1	0

Table B.4 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACSR	2	2	0	0	1	0	0	0	0	0	1
		CS-TJS	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	CO (8)	PDPJ	2	2	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	KS (20)	FDTJRP	1	1	0	1	0	0	1	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	NV (32)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG-CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	SD (46)	ACSR	2	2	0	0	1	0	0	1	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
	UT (49)	LSLJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	4	5	0	2	3	0	0	0	0	2	3

Table B.4 (cont’d)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	PDPJ	2	2	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	TJS	2	2	0	0	0	0	0	0	0	0	0
	MO (29)	CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	1	1	0	1	0	0	1	0	0	0	0
		PDPOJ	3	3	0	1	1	0	0	0	0	1	1
		TJS-LSLJS	2	2	0	0	1	0	0	0	0	0	1
	OH (39)	CS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
	PA (42)	ACSR	2	2	0	2	0	0	0	0	0	2	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPJ-SR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		SR	2	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	0	0	0	0	0	1	0	0	1
Wet –no-freeze	AR (5)	TJS-LSLJS	3	3	0	0	3	0	0	0	0	0	3
	OK (40)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG-CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	TJS-LSLJS	4	4	0	0	4	0	0	0	0	0	4
		CS-TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	1	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	1	0	0	0	0	0	1	0
		PDPJ-TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		PG	1	1	0	1	0	0	0	0	0	1	0

Table B.5 Summary of cracking data for SPS 5 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry no-freeze	AZ (4)	CS	7	7	0	3	0	0	0	0	0	3	0
		FSC	8	20	8	3	7	0	1	0	8	4	7
		M&F	4	4	0	0	4	0	0	0	0	0	4
		M&FRAC	4	4	0	0	3	0	0	1	0	0	4
	CA (6)	CS	5	5	0	5	0	0	0	0	0	5	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		M&F	4	4	0	0	4	0	0	0	0	0	4
		M&FRAC	4	4	0	0	4	0	0	0	0	0	4
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		SP	2	2	1	1	0	0	0	0	1	1	0
		STSL	7	7	2	0	5	0	0	0	2	0	5
	OK (40)	MPSP-TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		MPSP-TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		SP	9	10	0	0	9	0	0	0	0	0	9
		TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ASR-M&F	2	2	0	0	0	0	0	0	0	0	0
		TC-ASR-M&FRAC	2	2	0	0	0	0	0	0	0	0	0
	NM (35)	ACOL	8	8	0	0	4	0	0	0	0	0	4
		ACOL-STSL	5	5	0	0	4	0	0	1	0	0	5
		CS	1	1	0	0	0	0	0	0	0	0	0
		GS	5	5	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	4	1	0	0	0	1	0	1	1	0
		RACOL	3	3	0	0	0	0	0	0	0	0	0
		SP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		RACOL-SP	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.5 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry- freeze	AB (81)	ACSR-ACOL	2	2	0	0	1	0	0	0	0	0	1
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	5	4	2	1	0	0	0	0	2	1	0
		CS-PPH	3	3	3	0	0	0	0	0	3	0	0
		CS-TJS-PPH	2	2	0	0	0	0	0	0	0	0	0
		PPH	5	17	1	4	1	0	0	0	1	4	1
	CO (8)	ACOL/FSC	1	1	0	0	0	0	0	1	0	0	1
		ACOL-ACSR-FSC	2	2	0	0	0	0	0	2	0	0	2
		CS	9	9	0	0	0	0	9	0	0	9	0
		M&F-ACSR-FSC	2	2	0	0	0	0	0	2	0	0	2
		M&FARC-ACSR-FSC	2	2	0	0	0	0	0	2	0	0	2
		PPH	7	7	0	0	0	0	0	0	0	0	0
		RACOL-ACSR-FSC	2	2	0	0	0	0	0	2	0	0	2
	MT (30)	ACSR-M&FRAC	2	2	0	0	1	0	0	1	0	0	2
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		CS	8	8	0	0	8	0	0	0	0	0	8
		M&F-ASC	8	8	7	0	1	0	0	0	7	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0

Table B.5 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	MN (27)	ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	8	8	0	0	8	0	0	0	0	0	8
		M&FRAC	4	4	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		RACOL	2	2	0	0	0	0	0	0	0	0	0
		SP	9	18	5	9	3	0	0	0	5	9	3
	MB (83)	ACOL	1	1	0	0	0	0	0	1	0	0	1
		ASC	8	15	0	2	0	0	0	15	2	0	13
		CS	9	15	0	5	7	0	5	0	5	5	2
		M&F	2	2	0	0	0	0	0	2	0	0	2
		M&FRAC	2	2	0	0	0	0	0	1	0	0	1
		SP-ACOL	1	1	0	0	0	0	0	1	0	0	1
		MPP-ASC	1	1	0	0	0	0	0	1	0	0	1
Wet-no-freeze	AL (1)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	M & FRAC-ACSR	4	4	0	0	4	0	0	0	0	0	4
		M &F-ACSR	4	4	0	0	4	0	0	0	0	0	4
	MS (28)	MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.5 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MA (23)	ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		CS	9	9	0	8	0	8	0	0	0	8	0
		M&F-ACSR	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC-ACSR	2	2	0	0	2	0	0	0	0	0	2
		PPH	1	1	0	1	0	0	0	0	0	1	0
		RACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
	GA (13)	M & FRAC	1	1	0	0	1	0	0	0	0	0	1
		M & FRAC-ACSR	3	3	0	0	3	0	0	0	0	0	3
		M &F	1	1	0	0	1	0	0	0	0	0	1
		M &F-ACSR	3	3	0	0	3	0	0	0	0	0	3
	NJ (34)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPAP	1	1	0	0	0	0	0	0	0	0	0
		MPSP	2	2	0	0	2	0	0	0	0	0	2
		PPH	2	2	0	0	0	1	1	0	0	1	1

Table B.5 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	MPP-CS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-RACOL	1	1	0	0	0	0	1	0	0	1	0
		FDPAP	2	2	0	0	2	0	0	2	0	0	2
		M&F	3	3	0	0	3	0	3	0	3	0	0
		MPP	4	4	0	2	1	0	0	0	0	2	1
		MPP-ACSR_ACOL	2	2	0	0	0	0	0	0	0	0	0
		MPP-ACSR-HSRAC	1	1	0	0	0	0	0	1	0	0	1
		MPP-ACSR-M&FRAC	2	2	0	0	1	0	0	1	0	0	2
		MPP-ACSR-MPP	2	2	0	0	2	0	0	2	0	0	2

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Table B.6 Summary of cracking data for SPS-6 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AZ (4)	PDPJ	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS-PDPOJ-ACSR	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GRS-TJS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS-FDTJRP-PDPOJ-PCCSR-GS-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
		LS-FDTJRP-PDPOJ-SR	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		ACOL	4	4	0	0	0	0	0	4	0	0	4
		SAS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	1	0	0	1
		FT	2	2	0	0	0	0	0	0	0	0	0
		CS	5	5	0	0	0	0	5	0	0	5	0
		PPH	3	3	0	0	2	0	0	0	0	0	2
		SP	1	1	0	0	0	0	0	0	0	0	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACSR	3	3	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-LS-ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SAS-ACOL	1	1	0	0	0	0	0	1	0	0	1
		CS	6	11	0	4	1	0	0	0	0	4	1
		CS-GS-TJS-LSLJS-FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	4	5	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	2	4	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ-SR-LS	1	1	0	0	0	0	0	0	0	0	0
		GS-LS-TJS-FDTJRP-SR	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	2	2	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	0	1	0	1	0	0	1	1
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	1	0	0	0	0	0	1	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	SD (46)	ACOL-FDTJRP-PCCSR	2	2	0	0	0	0	0	0	0	0	0
		ACSR	6	6	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	1	0	0	0	0	0	1	0
		ACSR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ-PDPOJ	2	2	0	0	0	0	0	0	0	0	0
		ACSR-SSC	1	1	0	0	0	0	0	0	0	0	0
		ASC	7	7	1	3	0	0	0	4	2	2	3
		ASC-SAS	1	1	1	0	0	0	0	0	1	0	0
		CS-GSFDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS-LSLJS	3	3	0	1	0	0	0	0	0	1	0
		FDTJRP	2	2	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FTP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	7	0	0	1	0	0	0	0	0	1
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PGS-ACOL-LS-JLTR-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PGS-LS-JLTR-CS-GS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	0	0	0	0	0	0	0	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
		SSC-SAS	4	4	0	0	4	0	0	0	0	0	4

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACSR	4	4	0	0	2	0	0	0	0	0	2
		GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	4	4	0	0	3	0	0	0	0	0	3
		JLTR-TJS-GS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	3	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AK (5)	ACSR	3	3	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	0	3	0	0	0	0	0	3
		CS-GS-TJS	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	3	3	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPOJ	2	2	0	0	0	0	0	0	0	0	0
		FT	2	2	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	3	3	0	0	2	0	0	0	0	0	2
		JLTR-CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDPOJ-LS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	3	4	0	2	0	0	0	0	0	2	0
		PDPOJ	3	4	0	0	0	0	0	0	0	0	0
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	OK (40)	ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1
		CS	5	6	0	1	4	0	1	0	0	2	4
		FDTJRP	4	4	0	0	0	0	0	0	0	0	0
		FDTJRP-LS-TJS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		LS-FTP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-FTP-ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	1	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	3	0	0	1	0	0	0	0	0	1
		PDPJ-GS-TJS-ACSR	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	12	0	3	3	0	0	0	0	3	3
		SSC	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDTJRP	1	1	0	0	1	0	0	0	0	0	1

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TN (47)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-ACSR	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PCCSR-ACSR-ACOL -LS	1	1	0	0	1	0	0	0	0	0	1
		FTP-FDTJRP-PCCSR-ACSR -ACOL	1	1	0	0	0	0	0	0	0	0	0
		FTP-FDTJRP-PCCSR-ACSR-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-TJS-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LS	3	3	0	0	1	0	0	0	0	0	1
		MPP	1	3	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PCCSR-ACSR	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-PCCSR	2	3	0	1	0	0	0	0	0	1	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-GS-ACSR	1	1	0	0	0	0	0	0	0	0	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		ACSR	3	3	0	0	2	0	0	0	0	0	2
		CS	4	4	2	1	0	0	0	0	2	1	0
		CS-SP	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-ACSR	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-GS	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	2	3	0	0	0	0	0	0	0	0	0
		FDTJRP	3	5	0	0	0	0	0	0	0	0	0
		FDTJRP-PGS-LS	2	2	0	0	0	0	0	0	0	0	0
		FT-ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		LS	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	2	0	0	1	0	0	0	0	0	1
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	2	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		PPH	2	3	0	2	1	0	0	0	0	2	1
		SP	8	19	3	6	1	0	0	0	3	6	1
		TJS-ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	4	4	0	0	4	0	0	0	0	0	4
		ACSR-ACOL-SAS	1	1	0	0	2	0	0	0	0	0	1
		CS	5	9	1	4	4	0	0	0	1	4	4
		FDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-JLTR	1	1	0	0	0	1	0	0	0	0	1
		FDTJRP-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	0	1	0	0	0	0	0	1	0
		GS-FDPOJ-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		PDPJ-JLTR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-JLTR-FDTJRP-LS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	0	2	2	0	0	0	0	2	2
		SP	5	5	0	4	0	0	0	0	0	4	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IA (19)	ACOL	3	3	0	0	0	0	0	0	0	0	0
		ACOL-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACOL-LS-JLTR-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		ACSR-CS-SP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
		CS	8	12	0	1	4	0	0	0	0	1	4
		FDPAC	4	5	2	1	2	0	0	0	2	1	2
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	1	0	0	0	0	0	1	0
		LS-ACSR-ACOL	1	1	0	0	0	0	0	1	0	0	1
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		LS-JLTR-PDPJ-GS-TJS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	3	5	0	0	0	0	0	0	0	0	0
		PDPOJ-CS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-GS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	0	0	0	0	0	0	0
		SP	5	5	0	4	0	0	0	0	0	4	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	PDPJ-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACOL-FDTJRP-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		ACOL-TJS-FDTJRP-PDPJ-SAS	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-LS-GS-TJS-FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		ACOL-FT	2	2	0	0	2	0	0	0	0	0	2
		GS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
	MO (29)	CS	2	2	1	0	1	0	0	0	1	0	1
		CS-MPSP	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	2	0	0	0	0	0	0	0	0	0
		FDPOJ	3	7	0	0	0	0	0	0	0	0	0
		FDTJRP-ACOL	2	2	0	0	0	0	0	1	0	0	1
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PG-ACOL-LS	1	1	0	0	0	0	0	1	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT-ACOL	1	1	0	0	0	0	0	1	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PG-CS-FDTJRP-PCC	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
		SP	3	3	0	2	0	0	0	0	0	2	0
		SR	2	2	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ-LSLJS	3	11	0	0	0	0	0	0	0	0	0

Table B.6 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		CS-GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	0	0	0	0	0	0	0
		LSLJ-CS-GS-TJS-PG-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PGS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LSLJS	3	3	0	0	2	0	0	0	0	0	2
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	5	5	4	0	1	0	0	0	4	0	1
	PA (42)	ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1
		ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PCCSR-PGS-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		JLTR-GS-FDTJRP-PCCSR-PDPOJ-PGS-LS	1	1	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		LS-FTP-ACOL-LS	2	2	0	0	2	0	0	0	0	0	2
		PCCSR	2	2	0	0	0	0	0	0	0	0	0
		PDPJ	4	19	0	1	1	0	0	0	0	1	1
		PDPJ-PDPOJ	2	3	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	0	0	0	0	0	0	0	0	0

Table B.7 Summary of cracking data for SPS-7 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	LA (22)	FDPOJ-GS-SR-PCCOL	1	1	0	0	1	0	0	0	0	0	1
		GS-PCCSR-PCCOL	3	3	0	0	3	0	0	0	0	0	3
		PCCSR-PCCOL	4	4	0	0	4	0	0	0	0	0	4
Wet-freeze	MO (29)	ACSR-PCCOL-GS	1	1	0	0	1	0	0	0	0	0	1
		GS-TJS-LSLJS-FDTJRP-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-PCCOL	4	4	0	0	4	0	0	0	0	0	4
		GS-ACSR-PCCOL	2	2	0	0	2	0	0	0	0	0	2
		SR	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS-LSLJS	6	6	0	5	0	0	0	0	0	5	0
		CS	1	1	0	0	0	0	0	0	0	0	0
	IA (19)	PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	4	4	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PCCOL-GS-LSLJS	4	4	0	0	3	0	0	1	0	0	4
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		ACSR-PCCOL-LSLJS	4	4	0	0	3	0	0	0	0	0	3
		LSLJS-PDPJ	8	8	0	7	0	0	0	0	0	7	0
	MN (27)	LS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	8	0	1	0	0	0	0	0	1	0
		GS-LS-PCCOL	4	4	0	0	3	0	0	1	0	0	4
		LS-PCCOL	4	4	0	0	4	0	0	0	0	0	4
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0

Table B.8 Summary of cracking data for SPS-6A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	CS	1	1	0	0	0	0	0	0	0	0	0
		GS	1	1	0	0	0	0	0	0	0	0	0
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	0	0	1	0	0	0	0	0	1
		PPF-FSC	2	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		SSC	1	1	0	0	0	0	0	0	0	0	0
	NM (35)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-M&FCRAC	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	1	0	0	0	0	0	1
		PPF	1	2	0	1	0	0	0	0	0	1	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
Dry-freeze	CO (8)	ACOL	1	1	0	1	0	0	0	1	1	0	0
		PPH	3	3	0	0	0	0	0	0	0	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
		CS-STP	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	1	1	0	0	0	1	2	0	0
		CS	2	2	0	0	1	0	0	0	0	0	1
	MT (30)	CS-ACOL-ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1
	SD (46)	CS	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1

Table B.8 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	ACOL	1	1	0	1	0	0	0	1	1	0	0
		PPH	3	3	0	0	0	0	0	0	0	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
		CS-STP	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	1	1	0	0	0	1	2	0	0
		CS	2	2	0	0	1	0	0	0	0	0	1
	MT (30)	CS-ACOL-ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1
	SD (46)	CS	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1

Table B.8 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	TX (48)	CS	1	2	1	0	1	0	0	0	1	0	1
		PPH	1	5	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0
		CS-FSC	1	1	0	1	0	0	0	0	0	0	0
		ASC	2	2	1	0	0	0	0	0	1	0	0
	UT (49)	M&F-ASC	1	1	0	1	0	0	0	0	0	1	0
	WA (53)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		PPH	2	3	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F-ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	WY (56)	CS	2	2	0	1	0	0	0	0	0	1	0
		ACOL	2	3	0	1	1	0	0	0	0	1	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ASC	1	1	0	0	1	0	0	0	0	0	1

Table B.8 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPAC	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	AL (1)	FSC	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	AL (1)	M&F	1	1	0	0	1	0	0	0	0	0	1
Wet-no-freeze	OR (41)	MPP	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	OR (41)	M&F	1	1	0	0	0	0	0	1	0	0	1
Wet-no-freeze	TN (47)	PPH	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	BC (82)	ACOL	1	1	0	0	1	0	1	0	1	0	0
Wet-no-freeze	BC (82)	CS	2	2	0	2	0	0	0	0	0	2	0
Wet-no-freeze	BC (82)	HSSRAC	1	1	0	0	0	0	0	1	0	0	1
Wet-no-freeze	BC (82)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	AK (2)	CS	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	IN (18)	M&FRAC	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IN (18)	ACSR-M&F	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	IA (19)	CS	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	IA (19)	ACOL	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	IA (19)	MPP-STP	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	IA (19)	CS-PPH	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	ACSR-ACOL	1	1	0	0	0	0	0	1	0	0	1
Wet-freeze	KS (20)	ASC	2	2	0	1	0	0	1	1	1	1	0
Wet-freeze	KS (20)	ACOL	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	M&FRAC	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	M&F	1	1	0	0	0	0	1	0	0	1	0

Table B.8 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MN (27)	ACSR-M&FRAC-ACOL-CS	1	1	0	0	0	0	0	0	0	0	0
		SP	1	1	0	0	0	0	0	0	0	0	0
		SS	1	1	0	0	0	0	0	1	0	0	1
	PA (42)	ACSR	1	1	0	0	0	0	0	0	0	0	0
	AB (81)	CS	1	1	0	0	1	0	0	0	0	0	1
		CS-FDPAC	1	1	0	1	0	0	0	0	0	1	0
	NB (84)	M&F	1	2	0	0	1	0	1	0	1	0	0
	NS (86)	MPSP	1	2	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	0	0	0	1	0	0	1
		STP	1	1	0	0	0	0	0	0	0	0	0
	SK (90)	ASC	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	0	0	0	0	0	0	0	0
		SP	1	1	0	0	0	0	0	0	0	0	0

Table B.9 Summary of cracking data for SPS-6B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	ACOL	2	3	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	0	0	0	1	0	0	1
		SP	1	1	0	0	0	0	0	0	0	0	0
	ID (16)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ACOL-ASC	1	1	0	0	1	0	0	0	0	0	1
		STSL	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	M&F	2	3	0	0	1	0	0	1	0	0	2
		M&F-ASC	2	2	2	0	0	0	0	0	2	0	0
		CS	3	3	0	2	1	0	0	0	0	2	1
		ASC	2	2	0	0	0	0	0	1	0	0	1
		ACSR-ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	WA (53)	ACOL	3	4	0	0	3	0	0	0	0	0	3
		M&F	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	1	0	0	0	0	0	1	0
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	SD (46)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	0	0	0	0	0	0	0
		ACOL-ASC	1	1	0	0	0	0	0	0	0	0	0
	WY (56)	ACOL	4	4	0	0	1	0	0	1	0	0	2
		ASC	4	6	1	0	1	0	1	3	2	0	2
		CS	1	1	0	0	1	0	1	0	1	0	0
		ACOL-FSC	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	1	0	0	1	0

Table B.9 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACOL	2	2	0	1	1	0	0	1	1	0	1
		ASC-ACOL	1	1	0	0	1	0	0	0	0	0	1
	AR (5)	ACOL	1	1	1	0	0	0	0	0	1	0	0
	CA (6)	CS-MPP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL	9	13	0	3	6	0	0	2	1	2	7
		ACOL-GS	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	2	1	0	0	0	0	1	1	0	1
		CS	3	3	0	1	1	0	0	0	0	1	1
		CS-FDPAC-PPH	1	1	0	1	0	0	0	0	0	1	0
		CS-MPP	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		SS	1	1	0	0	0	0	0	1	0	0	1
		STSL	1	1	1	0	0	0	0	0	1	0	0
	FL (12)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	0	0	0	0	0	0	0	0
		STSL	3	3	0	0	3	0	0	0	0	0	3
	MS (28)	M&F	1	1	0	0	1	0	0	0	0	0	1
	OK (40)	ACOL	3	3	1	0	2	0	0	0	1	0	2
		ACOL-CS-FSC	1	1	0	0	1	0	0	0	0	0	1
		CS	2	2	0	2	0	0	0	0	0	2	0
	TN (47)	CS	3	3	0	2	0	0	0	0	0	2	0
		ACOL	7	8	4	0	3	1	0	0	5	0	3
		PPH	2	3	0	1	0	0	0	0	0	1	0
		FDPAC	2	2	0	1	1	0	0	0	0	1	1
		ACOL-MPSP	1	1	0	0	1	0	0	0	0	0	1

Table B.9 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TX (48)	SP-SS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	9	10	1	1	4	0	0	1	1	1	5
		PPH	3	5	0	1	0	0	0	0	0	1	0
		ASC-ACOL	5	5	2	0	2	0	0	1	2	0	3
		ASC	8	9	0	4	2	0	1	3	1	4	4
		SS	1	1	0	0	0	0	0	1	0	0	1
		MPP	4	4	1	1	1	0	0	0	1	1	1
		ACOL-STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		CS	3	3	1	0	2	0	1	0	2	0	1
	GA (13)	ACSR	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NC (37)	ACOL	2	2	0	1	1	0	0	0	0	1	1
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	2	0	0	1	0	0	0	0	0	1
		ACOL-SS	1	1	0	0	1	0	0	0	0	0	1
	SC (45)	ACOL	1	1	0	0	0	0	0	1	0	0	1
	SK (90)	ACOL	4	4	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	4	6	0	0	0	0	0	0	0	0	0
		ACSR	2	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0

Table B.9 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	CS	1	2	0	0	1	0	0	0	0	0	1
		ACSR-ACOL-FDPAC	1	1	1	0	0	0	0	0	1	0	0
	IN (18)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		SSC	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	FDPAC-CS	1	1	0	0	0	0	0	0	0	0	0
		CS-FSC	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
	MN (27)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	0	0	0	0	0	0	0
	MO (29)	ACOL-SP	1	1	0	0	0	0	0	1	0	0	1
		SP	1	1	0	0	0	0	0	0	0	0	0
		CS-SP	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	4	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	0	0	0	0	0	0	0
		STSL	1	1	0	0	0	0	0	1	0	0	1
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	2	0	0	0	0	0	0	0	0	0

Table B.9 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		FDPAC-ACOL-LS-TS	1	1	0	0	0	0	0	1	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
	VI (51)	ACOL	5	10	0	0	3	0	4	2	2	1	5
		PPH	1	1	1	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-RACOL	1	1	0	0	1	0	0	1	1	0	0
	DC (11)	M&F	1	1	0	0	0	0	0	0	0	0	0
	ME (23)	ACSR-ACOL	2	2	1	1	0	0	0	0	1	1	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
	VT (50)	ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	2	2	0	0	1	0	0	0	0	0	1
	WV (54)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
	AB (81)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	MB (83)	ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	2	4	0	0	0	0	0	0	0	0	0
		ASC	2	4	0	0	0	0	0	0	0	0	0
	PQ (89)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0

Table B.10 Summary of cracking data for SPS-6C test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	HSRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	CA (6)	CS	1	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	1	0	1	0	0	0	1	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
	DE (10)	CS	1	2	0	1	0	0	0	0	0	1	0
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
	FL (12)	ACSR-ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	RACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
	MS (28)	ACOL	1	2	1	1	0	0	0	1	2	0	0
	NC (37)	M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-FDPAC-RACOL	1	1	1	0	0	0	0	0	1	0	0
		STP-SS	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	1	0	0	0	0	0	1	0	0
		RACOL	4	4	0	0	4	0	0	0	0	0	4
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		ASC	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	2	0	0	0	0	0	2	0	0
	OK (40)	ACOL	1	1	0	1	0	0	0	1	1	0	0
	TX (48)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	MD (24)	RACOL-ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
	PA (42)	CS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-RACOL	1	1	0	1	0	0	0	0	0	1	0
	VA (51)	RACOL	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0

Table B.11 Summary of cracking data for SPS-6D test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACOL	1	1	0	0	1	0	1	0	1	0	0
		M&F	1	1	0	0	0	0	0	1	0	0	1
Wet-freeze	MA (25)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	1	0	0	0	0	0	1	0
	ON (87)	M&F	2	2	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&F	2	2	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1

Table B.12 Summary of cracking data for SPS-6S test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	PPH	6	8	0	1	0	0	0	0	0	1	0
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
		M&F	10	10	2	0	7	0	1	0	3	0	6
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
		FSC	3	3	0	0	1	0	0	0	0	0	1
		ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	3	5	0	1	1	0	0	0	0	1	1
		GS-PPH	1	1	0	0	0	0	0	0	0	0	0
		PPH-STSL	1	1	0	0	0	0	0	1	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
	CA (6)	M&F	2	2	1	0	1	0	0	0	1	0	1
		CS	2	2	0	1	0	0	0	0	0	1	0
		SP	1	1	0	1	0	0	0	0	0	1	0
	NM (35)	M&F	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PPH	1	2	0	0	0	0	1	0	0	1	0
		STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	1	0	0	0	0	0	1	0
	NV (32)	CS	1	2	0	1	1	0	0	0	0	1	1
		FSC	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	WY (56)	M&FRAC	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
	BC (82)	GS-RACOL-HSRAC	1	1	0	0	0	0	0	1	0	0	1
		ASC	1	1	0	0	1	0	1	0	1	0	0

Table B.12 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	M&FRAC	2	2	1	1	0	0	0	1	2	0	0
	AR (5)	MPSP	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACSR-MPSP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-RACOL	1	1	0	1	0	0	0	1	1	0	0
		ACSR-M&FRAC	1	1	0	1	0	0	0	1	1	0	0
		M&FRAC-STSL	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	MPP	2	2	0	0	2	0	0	0	0	0	2
		ACOL	2	2	0	2	0	0	0	2	2	0	0
	KY (21)	M&F	1	1	1	0	0	0	0	0	1	0	0
	MD (24)	GS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
	MS (28)	ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	2	2	0	0	0	0	0	0	0	0	0
		M&F	4	4	0	1	1	0	0	2	1	0	2
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACSR-M&F	1	1	0	0	0	0	0	1	0	0	1

Table B.12 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACSR-M&FRAC	2	3	0	1	1	0	0	0	0	1	1
		M&FRAC	1	1	0	0	1	0	1	0	1	0	0
		M&F	2	2	1	0	1	0	0	0	1	0	1
		STP-SS	1	1	0	0	0	0	0	1	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	1	0	0	0	0	0	1	0	0
	OK (40)	FSC	1	4	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	M&F	1	1	1	0	0	0	0	0	1	0	0
	TN (47)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	0	1	1	0	0	1	1	0	1
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	FSC	1	2	0	0	0	0	0	0	0	0	0
		TC	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	3	1	1	0	0	0	0	1	1	0
		GS-ACOL-SC	1	1	0	0	0	0	0	1	0	0	1
		SP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	0	1	1	0	0	0	0	1	1
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	VA (51)	M&F	2	2	1	0	1	0	0	0	1	0	1

Table B.12 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
	KS (20)	PPH	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	0	1	0	0	0	0	0	1	0
		ACOL	1	1	0	0	0	0	0	1	0	0	1
		ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	0	0	1	0	0	1	0
	ME (23)	ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
	MN (27)	PPH	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	3	3	0	1	1	0	1	1	2	0	0
		M&F	1	1	0	1	0	0	0	0	0	1	0
		CS	3	3	0	1	2	0	1	0	1	1	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		STSL	1	1	0	1	0	0	0	1	1	0	0
	NH (33)	ASC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	2	0	1	0	0	0	0	0	1	0

Table B.12 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	NJ (34)	ACOL	2	2	0	0	1	0	0	1	0	0	2
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	0	0	0	1	0	0	1
		M&FRAC	4	4	0	0	2	0	0	0	0	0	2
		MPSP	1	5	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	0	0	1	0	0	1	0
		STSL	1	1	0	1	0	0	0	1	1	0	0
	NY (36)	LS	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
	PA (42)	CS	1	3	0	1	1	0	0	0	0	1	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	VT (50)	CS	1	2	0	0	0	0	0	1	0	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	NB (84)	ACSR	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	ON (87)	M&F	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1

Table B.13 Summary of cracking data for SPS-7A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	M&F	1	1	0	0	1	0	0	0	0	0	1
		PPF	1	1	0	1	0	0	0	0	0	1	0
Wet-no-freeze	GA (13)	CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACSR-M&F	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	0	0	0	0	0	0	0
	TX (48)	ASC	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IL(17)	M&F	2	2	0	0	1	0	0	1	0	0	2
		CS	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		FDPAC-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	0	0	1	0	0	1	0
	KS (20)	PPH	1	1	0	0	0	0	0	0	0	0	0
		HSRAC	1	1	0	0	0	0	0	0	0	0	0
		SS	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0

Table B.13 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	CS	1	1	0	0	0	0	0	0	0	0	0
	MS (28)	PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL-PCCOL	1	1	0	0	0	0	0	1	0	0	1
		PDPJ	1	1	0	0	1	0	1	0	1	0	0
	NE (31)	ASC	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC-ACOL	1	1	0	0	0	0	0	1	0	0	1
		M&FRAC	2	2	0	0	1	0	0	0	0	0	1
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	0	0	0	0	0	0	0
	OH (39)	FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	RI (44)	PPH	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	SD (46)	ASC	1	3	0	0	0	0	0	1	0	0	1
		CS	1	1	0	0	0	0	0	0	0	0	0
	ON (87)	CS-PPF	1	2	0	0	0	0	0	0	0	0	0

Table B.14 Summary of cracking data for SPS-7B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	WA (53)	ACOL	1	1	0	0	1	0	0	0	0	0	1
Wet-no-freeze	DE (10)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	2	2	0	1	0	0	1	0	0	2	0
		ACSR-ACOL	1	1	0	0	0	0	0	1	0	0	1
		ACSR-ACOL-FDPAC	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
	MS (28)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	1	3	0	0	0	0	0	0	0	0	0
		ACSR-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	MO (29)	ACOL	2	2	0	0	0	0	0	1	0	0	1
		ASCR-ACOL	2	2	0	0	0	0	0	1	0	0	1
		CS	3	4	0	0	0	0	0	0	0	0	0
		SS	3	3	0	0	0	0	0	0	0	0	0
		SP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	2	0	0	0	0	0	0	0	0	0
		MPSP-CS	1	1	0	0	0	0	0	0	0	0	0
	NC (37)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
	VA (51)	GRS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
	WV (54)	FDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	1	0	0	1	0	0	2	0
		M&FRAC-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		FDPAC-PPH	1	1	0	0	0	0	0	0	0	0	0

Table B.14 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	MPP	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	1	1	0	0	1	1	1	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		FDPOJ-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ-ACOL	1	1	0	0	0	0	0	0	0	0	0
	ID (16)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
	IL (17)	FDPOJ	3	3	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	6	6	0	0	2	0	0	1	0	0	3
		CS	1	1	0	0	1	0	0	0	0	0	1
		MPP-FDPAC	2	2	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
	IN (18)	PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	4	4	0	0	1	0	0	2	0	0	3
		CS	2	4	0	0	0	0	0	0	0	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	2	2	0	0	1	0	0	0	0	0	1
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDPAC-M&F	1	1	0	0	1	0	1	0	1	0	0
		FDPAC-ACOL	1	1	0	0	1	0	1	0	1	0	0
	IA (19)	PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	4	4	1	0	1	0	0	0	1	0	1
		CS	2	2	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	2	0	0	0	0	0	0	0	0	0

Table B.14 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	KS (20)	ACOL	1	1	0	0	0	0	0	0	0	0	0
	MN (27)	ACOL	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	PDPJ	2	4	1	0	1	0	0	0	1	0	1
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	0	0	0	0
	OH (39)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		STSL	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	PA (42)	CS-TJS	1	1	0	0	1	0	0	0	0	0	1
		CS-LSJJS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL-SAS	1	1	0	0	0	0	0	0	0	0	0
		GS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL-LS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL-SAS	1	1	0	1	0	0	0	0	0	1	0
	VT (50)	CS	1	2	0	0	1	0	0	0	0	0	1
		FDPOJ-ACOL	1	1	0	0	0	0	0	0	0	0	0
	MB (83)	TJS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	0	0	0	1	0	0	1
		CS	1	1	0	0	0	0	0	0	0	0	0
	PQ (89)	PPH	1	1	0	0	0	0	0	0	0	0	0
		PPH-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PPH-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0

Table B.15 Summary of cracking data for SPS-7C test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	2	2	0	0	2	0	0	0	0	0	2
		M&F	1	1	0	1	0	0	0	0	0	1	0
	TX (48)	ASC	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0

Table B.15 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	IL (17)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		LSLJS-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		JLTR	1	1	0	0	0	0	0	0	0	0	0
		GS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	KS (20)	ACOL-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	NC (37)	M&F	1	1	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
	OH (39)	RACOL-FDPOJ-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	2	2	0	1	0	0	0	0	0	1	0
		ACSR	1	1	1	0	0	0	0	0	1	0	0
	PA (42)	LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	5	0	0	0	0	0	0	0	0	0
		ACSR-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-PDPJ	1	1	0	0	0	0	0	1	0	0	1
		PDPJ	1	1	0	1	0	0	0	0	0	1	0
		RACOL-PDPOJ	1	1	0	0	0	0	0	1	0	0	1
	PQ (89)	FT-M&F	1	1	0	0	1	0	1	0	1	0	0

Table B.16 Summary of cracking data for SPS-7D test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	ACOL-FT	2	2	1	0	1	0	0	0	1	0	1
		STSL	1	1	0	1	0	0	0	1	1	0	0

Table B.17 Summary of cracking data for GPS-9 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	PCCSR	2	2	0	1	0	0	0	0	0	1	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	PDPOJ	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	MI (26)	PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	MN (27)	PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	CS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
	OH (39)	PPH-PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		JTLR	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-GS	1	1	0	0	1	0	0	0	0	0	1
		PCCSR-OTHER	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	GS	2	2	1	0	0	0	0	0	1	0	0
		ACSR-ACOL-LS	1	1	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	1	0	0	0	0	0	1

Table B.18 Summary of IRI data for SPS-1 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry -no-freeze	AZ (4)	CS	6	9	2	4	3	0	0	0	2	4	3
		FDP	1	1	0	1	0	0	0	0	0	1	0
		PHP	1	1	1	0	0	0	0	0	1	0	0
		SS	6	6	4	0	2	0	0	0	4	0	2
	NM (35)	GS	2	2	0	2	0	0	0	0	0	2	0
	OK (40)	MPSP	1	1	1	0	0	0	0	0	1	0	0
		SP	12	12	0	0	12	0	0	0	0	0	12
	TX (48)	ACOL	12	12	0	2	0	0	0	0	0	2	0
		ASC	12	12	0	0	0	0	0	0	0	0	0
		GS	3	3	0	0	3	0	0	0	0	0	3
		MOAC-SR	12	12	12	0	0	0	0	0	12	0	0
		MPSP	10	10	0	10	0	0	0	0	0	10	0

Table B.18 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	KS (20)	CS	6	6	5	1	0	0	0	0	5	1	0
		CS-STP	1	1	1	0	0	0	0	0	1	0	0
		M&F	9	9	0	8	0	0	0	0	0	8	0
		PP	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	ASC	12	12	0	1	0	0	0	0	0	1	0
		CS	12	36	1	11	12	0	0	0	1	11	12
	NE (31)	GS	11	11	1	10	0	0	0	0	1	10	0
	NV (32)	CS	7	7	7	0	0	0	0	0	7	0	0
		FDP	1	1	1	0	0	0	0	0	1	0	0
		PPH	6	7	0	6	0	0	0	0	0	6	0
		SP	1	1	1	0	0	0	0	0	1	0	0

Table B.18 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet –no-freeze	AL (1)	FDP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	AR (5)	CS	8	8	4	4	0	0	0	0	4	4	0
		FDP	2	2	1	0	1	0	0	0	1	0	1
		MPSP	3	3	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	2	0	0	0	0	0	2
		CS-MPSP	1	1	0	1	0	0	0	0	0	1	0
		CS-PPH	0	1	0	1	0	0	0	0	0	1	0
Wet -Freeze	DE (10)	ACOL	12	12	0	0	12	0	0	0	0	0	12
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	IA (19)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS	6	6	0	0	6	0	0	0	0	0	6
		STP	12	12	12	0	0	0	0	0	12	0	0
	OH (39)	CS	1	1	0	1	0	0	0	0	0	1	0
		HMACR	1	1	1	0	0	0	0	0	1	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SR-MOAC	2	2	0	2	0	0	0	0	0	2	0
	MI (26)	CS	8	15	7	0	8	0	0	0	7	0	8
		CS-PPH	1	1	1	0	0	0	0	0	1	0	0
		MOAC	8	8	0	8	0	0	0	0	0	8	0
		SR-MOAC	8	8	0	8	0	0	0	0	0	8	0
	VA (51)	ACOL	11	11	0	11	0	0	0	0	0	11	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		STP	11	11	11	0	0	0	0	0	11	0	0

Table B.19 Summary of IRI data for SPS-2 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	PDPJ	2	2	1	1	0	0	0	0	1	1	0
		PDPJ-PDPOJ	3	3	2	0	1	0	0	0	2	0	1
	CA (6)	GS	1	1	1	0	0	0	0	0	0	0	0
		LSLJS	6	6	2	2	2	0	0	0	2	2	2
		LSLJS-TJS	7	10	2	1	7	0	0	0	2	1	7
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PDPJ	5	8	4	2	2	0	0	0	4	2	2
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
	NV (32)	CS	6	10	0	0	6	0	0	0	0	0	6
		FDPOJ	1	4	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	3	6	0	2	1	0	0	0	0	2	1
		CS-PDPJ	2	2	0	0	1	0	0	0	0	0	1
		CS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	AR (5)	CS	1	1	0	1	0	0	0	0	0	1	0
		CS-PDPJ	1	1	1	0	0	0	0	0	1	0	0
		CS-TJS	1	1	1	0	0	0	0	0	1	0	0
		LSLJS	12	12	0	0	11	0	0	0	0	0	11
		PDPJ	3	4	2	0	0	0	0	0	2	0	0
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	2	0	0	0	0	0	2	0	0
	NC (37)	PDPJ	1	1	0	0	1	0	0	0	0	0	1

Table B.19 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	DE (10)	CS/OTHER	1	1	0	0	0	0	0	0	0	0	0
		CS/PPH	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	2	0	0	0	0	0	2
		GS	7	7	7	0	0	0	0	0	7	0	0
		LSLJS	3	3	2	1	0	0	0	0	2	1	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	IA (19)	TJS-LSLJS-SR	1	1	0	0	1	0	0	0	0	0	1
		SR	1	1	0	1	0	0	0	0	0	1	0
	KS (20)	FDTJRP	5	5	0	5	0	0	0	0	0	5	0
		FDTJRP-FDPOJ	3	3	0	2	0	0	0	0	0	2	0
		PDPJ	4	6	0	2	1	0	0	0	0	2	1
		PDPJ-SR	1	1	1	0	0	0	0	0	1	0	0
		SR	1	2	0	1	0	0	0	0	0	1	0
		TJS	3	3	2	0	1	0	0	0	2	0	1
		TJS-LSLJS	9	9	7	2	0	0	0	0	7	2	0
	OH (39)	OTHER	3	3	0	3	0	0	0	0	0	3	0
	MI (26)	ACSR	1	2	1	1	0	0	0	0	1	1	0
		LSLJS	7	7	6	1	0	0	0	0	6	1	0
		PDPJ	5	6	5	0	1	0	0	0	5	0	1
		SR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0

Table B.20 Summary of IRI data for SPS-3 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	ACOL	4	4	0	0	3	0	0	0	0	0	3
		ASC	4	4	0	0	2	0	0	0	0	0	2
		CS	4	5	0	0	2	0	0	0	0	0	2
		MPP	4	4	0	0	2	0	0	0	0	0	2
		MPSP	2	2	0	0	0	0	0	0	0	0	0
		SS	4	4	0	0	1	0	0	0	0	0	1
	OK(40)	ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	ACOL	8	8	0	0	8	0	0	0	0	0	8
		ASC	8	8	0	0	6	0	0	0	0	0	6
		CS	16	18	0	5	1	0	0	0	0	5	1
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		CS-SP	2	2	0	0	0	0	0	0	0	0	0
		FDPAC	4	5	0	4	0	0	0	0	0	4	0
		FSC	1	1	0	0	1	0	0	0	0	0	1
		SP	7	16	0	1	1	0	0	0	0	1	1
		SS	8	8	0	0	4	0	0	0	0	0	4

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	7	4	1	2	0	0	0	4	1	2
		SS	1	1	0	0	1	0	0	0	0	0	1
	CO (8)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	2	3	0	0	2	0	0	0	0	0	2
		PPH	1	1	1	0	0	0	0	0	1	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
		SS	2	2	0	0	0	0	0	2	0	0	2
		STSL	1	1	0	0	0	0	0	0	0	0	0
	ID (16)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	3	0	0	0	0	0	3
		SS	3	3	0	0	3	0	0	0	0	0	3
	KS (20)	ACOL	2	2	0	0	1	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	6	8	1	5	2	0	0	0	1	5	2
		FDACP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	0	1	0	0	0	0	0	1
	MT (30)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACS	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	NE (31)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	4	5	2	2	1	0	0	0	2	2	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	NV (32)	ACOL	3	3	0	0	2	0	0	0	0	0	2
		ASC	3	3	0	0	1	0	0	0	0	0	1
		CS	3	3	0	0	2	0	0	0	0	0	2
		MPSP	4	6	1	2	0	0	0	0	1	2	0
		SS	3	3	0	2	0	0	0	0	0	2	0
	UT (49)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	4	5	0	2	3	0	0	0	0	2	3
		SS	2	2	0	0	2	0	0	0	0	0	2
	WA (53)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	4	1	1	2	0	0	0	1	1	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	WY (56)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	SK (90)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	2	2	0	0	2	0	0	0	0	0	2
		FDPAC	2	3	0	2	1	0	0	0	0	2	1
		MPSP	2	7	0	1	0	0	0	0	0	1	0
		MPSP-ASC	1	1	0	0	0	0	0	0	0	0	0
		PPH	4	4	1	2	0	0	0	0	1	2	0
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	2	0	0	0	0	0	2
		CS	5	6	0	3	1	0	0	0	0	3	1
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	10	0	2	0	0	0	0	0	2	0
		SS	3	3	0	0	2	0	0	0	0	0	2
	AR (5)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	2	0	0	0	0	0	2
		PPH	2	5	0	0	0	0	0	0	0	0	0
		SS	3	3	0	0	2	0	0	0	0	0	2
	OK (40)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	2	3	0	0	1	0	0	0	0	0	1
		MPP	2	4	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		SS	2	2	0	0	1	0	0	0	0	0	1

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TN (47)	ACOL	3	3	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	2
		CS	4	8	1	0	0	0	0	0	1	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	2	0	0	0	0	0	0	0	0	0
		SS	2	2	0	0	1	0	0	0	0	0	1
		SS-CS	1	1	0	0	1	0	0	0	0	0	1
		ACS-CS	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACOL	6	6	0	0	6	0	0	0	0	0	6
		SS	5	5	0	0	4	0	0	0	0	0	4
		ASC	5	5	0	0	3	0	0	0	0	0	3
		MPSP	4	4	0	1	0	0	0	0	0	1	0
		CS	6	8	0	0	1	0	0	0	0	0	1
		MPP	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	1	0	0	0	0	0	1	0	0
		CS-SS	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	2	0	0	0	0	0	0	0	0	0
		ACSR	4	4	0	4	0	0	0	0	0	4	0

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	3	4	1	0	3	0	0	0	1	0	3
		LS-LJS	2	3	2	0	1	0	0	0	2	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	2	0	0	0	0	0	2
	IN (18)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	KY (21)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-CS	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	ACOL	4	4	0	0	4	0	0	0	0	0	4
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	6	6	0	0	4	0	0	0	0	0	4
		MPSP	3	4	0	2	1	0	0	0	0	2	1
		PPH	1	1	1	0	0	0	0	0	1	0	0
		SS	4	4	0	0	4	0	0	0	0	0	4
	MN (27)	ACOL	3	3	0	0	2	0	0	0	0	0	2
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	5	5	0	0	3	0	0	0	0	0	3
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	1	1	0	0	0	0	1	1
		SS	4	4	0	0	4	0	0	0	0	0	4
	MO (29)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	6	3	1	2	0	0	0	3	1	2
		CS-PPH	1	1	0	1	0	0	0	0	0	1	0
		CS-STP	5	5	4	1	0	0	0	0	4	1	0
		CS-STP-SP	3	3	0	0	3	0	0	0	0	0	3
		MPSP	3	6	3	1	0	0	0	0	3	1	0
		SS	2	2	0	0	2	0	0	0	0	0	2
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	1	0	0	0	0	0	1
		MPP	2	2	0	0	0	0	0	0	0	0	0
		MPSP	3	3	1	2	0	0	0	0	1	2	0
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		PPH	6	4	0	2	3	0	0	0	0	2	3
		SS	2	2	0	0	0	0	0	0	0	0	0
		STP	1	1	0	1	0	0	0	0	0	1	0

Table B.20 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	3	5	0	2	1	0	0	0	0	2	1
		CS-MPSP	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	1	1	0	0	0	0	1	1
		SS	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	2	2	0	0	2	0	0	0	0	0	2
	ON (87)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	3	3	0	0	3	0	0	0	0	0	3
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	0	0	0	0	0	0	0
	PQ (89)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	2	0	0	0	0	0	2
		SS	1	1	0	0	0	0	0	0	0	0	0

Table B.21 Summary of IRI data for SPS-4 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	CA (6)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
		FDPOJ	1	3	0	0	1	0	0	0	0	0	1
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	3	8	0	1	0	0	0	0	0	1	0

Table B.21 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACSR	2	2	0	0	2	0	0	0	0	0	2
		CS-TJS	2	2	0	2	0	0	0	0	0	2	0
		CS-TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
		FDPOJ	1	1	0	1	0	0	0	0	0	1	0
	CO (8)	PDPJ	2	2	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	KS (20)	FDTJRP	1	1	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-PDPJ	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	PDPJ	2	5	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
	NV (32)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG-CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	1	1	1	0	0	0	0	0	1	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	SD (46)	ACSR	2	2	0	0	2	0	0	0	0	0	2
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	1	0	0	0	0	0	1	0
	UT (49)	LSLJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	4	5	0	2	3	0	0	0	0	2	3

Table B.21 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	PDPJ	2	2	0	1	0	0	0	0	0	1	0
Wet-freeze	IN (18)	TJS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IN (18)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IA (19)	TJS	2	2	0	0	2	0	0	0	0	0	2
Wet-freeze	MO (29)	CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	MO (29)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	MO (29)	FDTJRP	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	MO (29)	PDPJ	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	MO (29)	PDPOJ	3	3	0	1	0	0	0	0	0	1	0
Wet-freeze	MO (29)	TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
Wet-freeze	OH (39)	CS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	OH (39)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	OH (39)	PDPJ	2	2	0	0	1	0	0	0	0	0	1
Wet-freeze	OH (39)	TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
Wet-freeze	PA (42)	ACSR	2	2	0	2	0	0	0	0	0	2	0
Wet-freeze	PA (42)	FDPOJ	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	PA (42)	FDPOJ-PDPJ-SR	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	PA (42)	PDPJ	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	PA (42)	PDPJ-PDPOJ	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	PA (42)	PDPOJ	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	PA (42)	SR	2	2	0	0	0	0	0	0	0	0	0
Wet-freeze	PA (42)	TJS-LSLJS	2	2	0	0	1	0	0	0	0	0	1
Wet-no-Freeze	AK (5)	TJS-LSLJS	3	3	0	0	3	0	0	0	0	0	3
Wet-no-Freeze	OK (40)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
Wet-no-Freeze	OK (40)	PG-CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
Wet-no-Freeze	TX (48)	TJS-LSLJS	4	4	0	0	4	0	0	0	0	0	4
Wet-no-Freeze	TX (48)	CS-TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
Wet-no-Freeze	TX (48)	FDTJRP	1	1	0	0	0	0	0	0	0	0	0
Wet-no-Freeze	TX (48)	FDTJRP-PDPJ	1	1	1	0	0	0	0	0	0	0	0
Wet-no-Freeze	TX (48)	PDPJ	1	1	0	1	0	0	0	0	0	1	0
Wet-no-Freeze	TX (48)	PDPJ-TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
Wet-no-Freeze	TX (48)	PG-TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0

Table B.22 Summary of IRI data for SPS-5 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	CS	7	7	0	3	0	0	0	0	0	4	0
		FSC	8	20	9	4	7	0	0	0	9	4	7
		M&F	4	4	0	0	4	0	0	0	0	0	4
		M&FRAC	4	4	0	0	4	0	0	0	0	0	4
	CA (6)	CS	5	5	0	5	0	9	0	0	0	5	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		M&F	4	4	4	0	0	0	0	0	4	0	0
		M&FRAC	4	4	4	0	0	0	0	0	4	0	0
		RACOL	1	1	1	0	0	0	0	0	0	0	0
		SP	2	2	1	1	0	0	0	0	1	1	0
		STSL	7	7	2	0	5	0	0	0	2	0	5
	OK (40)	MPSP-TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		MPSP-TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		SP	9	10	0	0	9	0	0	0	0	0	9
		TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ASR-M&F	2	2	0	0	0	0	0	0	0	0	0
		TC-ASR-M&FRAC	2	2	0	0	0	0	0	0	0	0	0
	NM (35)	ACOL	8	8	0	0	4	0	0	0	0	0	4
		ACOL-STSL	5	5	0	0	5	0	0	0	0	0	5
		CS	1	1	0	0	0	0	0	0	0	0	0
		GS	5	5	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	4	1	1	0	0	0	0	1	1	0
		SP-ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	3	3	0	0	0	0	0	0	0	0	0
		RACOL-SP	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.22 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AB (81)	ACSR-ACOL	2	2	0	0	1	0	0	0	0	0	1
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	5	6	3	1	1	0	0	0	3	1	1
		CS-PPH	3	3	3	0	0	0	0	0	3	0	0
		CS-TJS-PPH	1	1	1	0	0	0	0	0	1	0	0
		PPH	6	16	2	5	1	0	0	0	2	5	1
	CO (8)	ACOL-FSC	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
		CS	9	9	1	8	0	0	0	0	1	8	0
		M&F-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
		M&FARC-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
		PPH	7	7	0	0	0	0	0	0	0	0	0
		RACOL-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
	MT (30)	ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		CS	8	8	0	8	0	0	0	0	0	8	0
		M&F-ASC	8	8	7	0	1	0	0	0	7	0	1
		PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.22 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	MN (27)	ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	8	8	0	0	8	0	0	0	0	0	8
		M&FRAC	4	4	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		RACOL	2	2	0	0	0	0	0	0	0	0	0
		SP	9	18	8	6	2	0	0	0	8	6	2
	MB (83)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	8	15	0	8	7	0	0	0	0	8	7
		CS	9	15	0	14	0	0	0	0	0	14	0
		M&F	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		SP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPP-ASC	1	1	0	0	1	0	0	0	0	0	1
		RACOL	2	2	0	0	2	0	0	0	0	0	2
Wet-no-freeze	AL (1)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	M & FRAC-ACSR	4	4	0	0	4	0	0	0	0	0	4
		M &F-ACSR	4	4	0	0	4	0	0	0	0	0	4
	MS (28)	MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.22 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MA (23)	ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		CS	9	9	0	8	0	0	0	0	0	8	0
		M&F-ACSR	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC-ACSR	2	2	0	0	2	0	0	0	0	0	2
		PPH	1	1	0	1	0	0	0	0	0	1	0
		RACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
	GA (13)	M & FRAC-ACSR	3	3	0	0	3	0	0	0	0	0	3
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		M &F-ACSR	3	3	0	0	3	0	0	0	0	0	3
	NJ (34)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPAC	1	1	0	0	1	0	0	0	0	1	0
		MPSP	2	2	1	0	1	0	0	0	1	0	1
		PPH	2	2	2	0	0	0	0	0	2	0	0

Table B.22 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	MPP-CS	1	1	0	0	0	0	0	0	1	0	0
		ACSR-RACOL	1	1	1	0	0	0	0	0	1	0	0
		FDPAP	2	2	2	0	0	0	0	0	2	0	0
		M&F	3	3	2	0	1	0	0	0	2	0	1
		MPP	4	4	0	3	1	0	0	0	0	3	1
		MPP-ACSR-ACOL	2	2	2	0	0	0	0	0	2	0	0
		MPP-ACSR-HSRAC	1	1	0	1	0	0	0	0	0	1	0
		MPP-ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		MPP-ACSR-MPP	2	2	2	0	0	0	0	0	2	0	0

Table B.23 Summary of IRI data for SPS-6 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AZ (4)	PDPJ	2	2	0	0	1	0	0	0	0	0	1
		CS-TJS-LSLJS-PDPOJ-ACSR	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GRS-TJS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS-FDTJRP-PDPOJ-PCCSR-GS-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
		LS-FDTJRP-PDPOJ-SR	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		ACOL	4	4	0	0	4	0	0	0	0	0	4
		SAS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		FT	2	2	0	0	0	0	0	0	0	0	0
		CS	5	5	5	0	0	0	0	0	5	0	0
		PPH	3	3	3	0	0	0	0	0	3	0	0
		SP	1	1	0	1	0	0	0	0	0	1	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACSR	3	3	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-LS-ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SAS-ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	6	11	0	4	0	0	0	0	0	4	0
		CS-GS-TJS-LSLJS-FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	4	5	0	0	0	0	0	0	0	0	0
		FDPOJ	2	4	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ-SR-LS	1	1	0	0	0	0	0	0	0	0	0
		GS-LS-TJS-FDTJRP-SR	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	2	2	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	0	1	0	0	0	0	0	1
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	1	0	0	0	0	0	1	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	SD (46)	ACOL-FDTJRP-PCCSR	2	2	0	0	0	0	0	0	0	0	0
		ACSR	6	6	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	0	0	0	0	0	0	0	0
		ACSR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ-PDPOJ	2	2	0	2	0	0	0	0	0	2	0
		ACSR-SSC	1	1	0	0	0	0	0	0	0	0	0
		ASC	7	7	1	4	3	0	0	0	1	4	3
		ASC-SAS	1	1	1	0	0	0	0	0	1	0	0
		CS-GSFDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS-LSLJS	3	3	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	1	0	0	0	0	0	1
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FTP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	7	1	1	2	0	0	0	1	1	2
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PGS-ACOL-LS-JLTR-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PGS-LS-JLTR-CS-GS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	0	3	0	0	0	0	0	3
		SSC	1	1	0	0	1	0	0	0	0	0	1
		SSC-SAS	4	4	0	0	4	0	0	0	0	0	4

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACSR	4	4	0	0	2	0	0	0	0	0	2
		GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	4	4	0	0	3	0	0	0	0	0	3
		JLTR-TJS-GS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-LS	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	3	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AK (5)	ACSR	3	3	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	0	3	0	0	0	0	0	3
		CS-GS-TJS	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	3	3	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPOJ	2	2	0	0	0	0	0	0	0	0	0
		FT	2	2	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	3	3	0	0	2	0	0	0	0	0	2
		JLTR-CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDPOJ-LS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	3	4	0	2	0	0	0	0	0	2	0
		PDPOJ	3	4	0	0	0	0	0	0	0	0	0
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	OK (40)	ACOL-ACSR	1	1	0	0	0	0	0	0	0	0	0
		ACOL-ACSR-SAS	1	1	0	0	0	0	0	0	0	0	0
		CS	5	6	0	0	5	0	0	0	0	0	5
		FDTJRP	4	4	0	0	0	0	0	0	0	0	0
		FDTJRP-LS-TJS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	0	0	0	0	0	0	0
		LS-FTP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		LS-FTP-ACOL-ACSR	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	1	0	0	0	0	0	1	0	0
		PDPJ	1	3	0	0	1	0	0	0	0	0	1
		PDPJ-GS-TJS-ACSR	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	12	0	1	3	0	0	0	0	1	3
		SSC	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	1

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TN (47)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-ACSR	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PCCSR-ACSR-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		FTP-FDTJRP-PCCSR-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		FTP-FDTJRP-PCCSR-ACSR-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		GS-TJS-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LS	3	3	0	0	1	0	0	0	0	0	1
		MPP	1	3	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PCCSR-ACSR	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ	3	5	0	1	0	0	0	0	0	1	0
		PDPOJ-PCCSR	3	4	0	1	0	0	0	0	0	1	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-GS-ACSR	1	1	0	0	0	0	0	0	0	0	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR	2	2	0	0	0	0	0	0	0	0	0
		ACSR	3	3	0	0	2	0	0	0	0	0	2
		CS	4	4	2	0	2	0	0	0	2	0	2
		CS-SP	1	1	1	0	0	0	0	0	1	0	0
		CS-TJS-ACSR	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-GS	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	2	3	0	1	0	0	0	0	0	1	0
		FDTJRP	3	5	0	1	1	0	0	0	0	1	1
		FDTJRP-PGS-LS	2	2	0	0	0	0	0	0	0	0	0
		FT-ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		LS	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	2	0	0	0	0	0	0	0	0	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	2	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		PPH	2	3	0	2	1	0	0	0	0	2	1
		SP	8	19	0	10	4	0	0	0	0		4
		TJS-ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	4	4	0	0	4	0	0	0	0	0	4
		ACSR-ACOL-SAS	1	1	0	0	1	0	0	0	0	0	1
		CS	5	9	1	4	4	0	0	0	1	4	4
		FDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-JLTR	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	1	0	0	0	0	0	1	0	0
		GS-FDPOJ-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		PDPJ-JLTR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-JLTR-FDTJRP-LS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	1	2	1	0	0	0	1	2	1
		SP	5	5	0	4	0	0	0	0	0	4	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IA (19)	ACOL	3	3	0	0	0	0	0	0	0	0	0
		ACOL-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACOL-LS-JLTR-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		ACSR-CS-SP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-CS-SP	1	1	0	0	0	0	0	0	0	0	0
		CS	8	12	1	2	6	0	0	0	1	2	6
		FDPAC	4	5	2	1	2	0	0	0	2	1	2
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	1	0	0	0	0	0	1	0
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		LS-JLTR-PDPJ-GS-TJS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	1	0	0	0	0	0	1	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	3	5	0	0	0	0	0	0	0	0	0
		PDPOJ-CS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-GS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	0	0	0	0	0	0	0
		SP	5	5	0	4	0	0	0	0	0	4	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	PDPJ-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACOL-FDTJRP-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		ACOL-TJS-FDTJRP-PDPJ-SAS	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-LS-GS-TJS-FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		ACOL-FT	2	2	0	0	2	0	0	0	0	0	2
		GS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	1	0	0	0	0	0	1	0	0
	MO (29)	CS	2	2	2	0	0	0	0	0	2	0	0
		CS-MPSP	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	2	0	0	0	0	0	0	0	0	0
		FDPOJ	3	7	0	1	0	0	0	0	0	1	0
		FDTJRP-ACOL	2	2	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PG-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT-ACOL	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	1	0	0	0	0	0	1	0	0
		PG-CS-FDTJRP-PCC	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
		SP	3	3	0	3	0	0	0	0	0	3	0
		SR	2	2	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ-LSLJS	3	11	0	0	0	0	0	0	0	0	0

Table B.23 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	CS-TJS	1	1	0	0	1	0	0	0	0	0	1
		CS-GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	0	0	0	0	0	0	0
		LSLJ-CS-GS-TJS-PG-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PGS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LSLJS	3	3	0	1	2	0	0	0	0	1	2
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	5	5	0	4	0	0	0	0	0	4	0
	PA (42)	ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1
		ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		JLTR-FDTJRP-PCCSR-PGS-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		JLTR-GS-FDTJRP-PCCSR-PDPOJ-PGS-LS	1	1	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		LS-FTP-ACOL-LS	2	2	0	0	2	0	0	0	0	0	2
		PCCSR	2	2	0	0	0	0	0	0	0	0	0
		PDPJ	4	19	1	2	4	0	0	0	1	2	4
		PDPJ-PDPOJ	2	3	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	0	1	0	0	0	0	0	1	0

Table B.24 Summary of IRI data for SPS-7 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	LA (22)	FDPOJ-GS-SR-PCCOL	1	1	0	0	1	0	0	0	0	0	1
		GS-PCCSR-PCCOL	3	3	0	0	3	0	0	0	0	0	3
		PCCSR-PCCOL	4	4	0	0	4	0	0	0	0	0	4
Wet-freeze	MO (29)	ACSR-PCCOL-GS	1	1	0	0	1	0	0	0	0	0	1
		GS-TJS-LSLJS-FDTJRP-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-PCCOL	4	4	0	0	4	0	0	0	0	0	4
		GS-ACSR-PCCOL	2	2	0	0	2	0	0	0	0	0	2
		SR	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	1	0	0	0	0	0	1	0	0
		CS-TJS-LSLJS	6	6	3	2	1	0	0	0	3	2	1
		CS	1	1	1	0	0	0	0	0	1	0	0
	IA (19)	PDPJ-PDPOJ	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-PDPJ	4	4	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PCCOL-GS-LSLJS	4	4	0	0	4	0	0	0	0	0	4
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		ACSR-PCCOL-LSLJS	4	4	0	0	4	0	0	0	0	0	4
		LSLJS-PDPJ	8	8	0	8	0	0	0	0	0	8	0
	MN (27)	LS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	8	0	2	1	0	0	0	0	2	1
		GS-LS-PCCOL	4	4	0	0	3	0	0	0	0	0	3
		LS-PCCOL	4	4	0	0	4	0	0	0	0	0	4
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0

Table B.25 Summary of IRI data for GPS-6A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	CS	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	1	1	0	0	0	0	1	1	0
		PPF-FSC	2	2	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
	NM (35)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-M&FCRAC	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	2	0	1	0	0	0	0	0	1	0
		SSC	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		PPH	3	3	0	2	0	0	0	0	0	2	0
		STP	1	1	1	0	0	0	0	0	1	0	0
		CS-STP	1	1	0	1	0	0	0	0	0	1	0
		M&F	2	2	2	0	0	0	0	0	2	0	0
		CS	2	2	1	0	0	0	0	0	1	0	0
	MT (30)	CS-ACOL-ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1
	SD (46)	CS	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1

Table B.25 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	TX (48)	CS	1	2	1	0	1	0	0	0	1	0	1
		PPH	1	5	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS-FSC	1	1	0	1	0	0	0	0	0	0	0
		ASC	2	2	1	0	0	0	0	0	1	0	0
	UT (49)	M&F-ASC	1	1	0	1	0	0	0	0	0	1	0
	WA (53)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		RACOL	1	1	1	0	0	0	0	0	1	0	0
		PPH	2	3	1	1	1	0	0	0	1	1	1
		CS	1	1	0	1	0	0	0	0	0	1	0
		M&F-ACOL	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
	WY (56)	CS	2	2	0	2	0	0	0	0	0	2	0
		ACOL	2	3	1	1	0	0	0	0	1	1	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0

Table B.25 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (ode)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPAC	1	1	0	1	0	0	0	0	0	1	0
		FSC	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	MPP	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	TN (47)	PPH	1	1	0	0	0	0	0	0	0	0	0
	BC (82)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	2	2	0	2	0	0	0	0	0	2	0
		HSSRAC	1	1	0	1	0	0	0	0	0	1	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	AK (2)	CS	1	1	0	1	0	0	0	0	0	1	0
	IN (18)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		ACSR-M&F	1	1	0	1	0	0	0	0	0	1	0
	IA (19)	CS	1	1	0	1	0	0	0	0	0	1	0
		ACOL	1	1	1	0	0	0	0	0	1	0	0
		MPP-STP	1	1	0	0	0	0	0	0	0	0	0
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
	KS (20)	ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		ASC	2	2	0	1	0	0	0	0	0	1	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	0	0	0	0	0	0	0	0	0

Table B.25 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MN (27)	ACSR-M&FRAC-ACOL-CS	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	1	0	0	0	0	0	1	0	0
		SS	1	1	0	1	0	0	0	0	0	1	0
	PA (42)	ACSR	1	1	1	0	0	0	0	0	1	0	0
	AB (81)	CS	1	1	0	0	1	0	0	0	0	0	1
		CS-FDPAC	1	1	0	1	0	0	0	0	0	1	0
	NB (84)	M&F	1	2	2	0	0	0	0	0	2	0	0
	NS (86)	MPSP	1	2	1	1	0	0	0	0	1	1	0
		M&F	1	1	1	0	0	0	0	0	1	0	0
		STP	1	1	0	0	1	0	0	0	0	0	1
	SK (90)	ASC	1	1	1	0	0	0	0	0	1	0	0
		MPP	1	1	1	0	0	0	0	0	1	0	0
		SP	1	1	1	0	0	0	0	0	1	0	0

Table B.26 Summary of IRI data for GPS-6B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	ACOL	2	3	0	1	1	0	0	0	0	1	1
		ASC	1	1	1	0	0	0	0	0	1	0	0
		SP	1	1	1	0	0	0	0	0	1	0	0
	ID (16)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
		STSL	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	M&F	2	3	2	1	0	0	0	0	2	1	0
		M&F-ASC	2	2	2	0	0	0	0	0	2	0	0
		CS	3	3	0	2	1	0	0	0	0	2	1
		ASC	2	2	1	0	0	0	0	0	1	0	0
		ACSR-ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	1	0	0	0	0	0	1	0	0
	WA (53)	ACOL	3	4	0	0	4	0	0	0	0	0	4
		M&F	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0
		PPH	2	2	1	1	0	0	0	0	1	1	0
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	SD (46)	ACOL	4	4	0	2	0	0	0	0	0	2	0
		ASC	4	6	0	0	4	0	0	0	0	0	4
		CS	1	1	0	0	1	0	0	0	0	0	1
		ACOL-FSC	1	1	0	1	0	0	0	0	0	1	0
	WY (56)	STSL	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	2	0	0	0	0	0	2
		ASC	1	1	1	0	0	0	0	0	1	0	0
		ACOL-ASC	1	1	0	1	0	0	0	0	0	1	0

Table B.26 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		ASC-ACOL	1	1	0	0	1	0	0	0	0	0	1
	AR (5)	ACOL	1	1	1	0	0	0	0	0	1	0	0
	CA (6)	CS-MPP-ACOL	1	1	1	0	0	0	0	0	1	0	0
		ACOL	9	13	5	2	4	0	0	0	5	2	4
		ACOL-GS	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	2	2	0	0	0	0	0	2	0	0
		CS	3	3	1	2	0	0	0	0	1	2	0
		CS-FDPAC-PPH	1	1	0	1	0	0	0	0	0	1	0
		CS-MPP	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		SS	1	1	0	0	1	0	0	0	0	0	1
		STSL	1	1	1	0	0	0	0	0	1	0	0
	FL (12)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	3	3	0	0	0	0	0	0	0	0	0
		STSL	3	3	0	0	3	0	0	0	0	0	3
	MS (28)	M&F	1	1	0	0	1	0	0	0	0	0	1
	OK (40)	ACOL	3	3	2	0	1	0	0	0	2	0	1
		ACOL-CS-FSC	1	1	0	0	1	0	0	0	0	0	1
		CS	2	2	0	2	0	0	0	0	0	2	0
	TN (47)	CS	3	3	1	0	2	0	0	0	1	0	2
		ACOL	7	8	3	1	4	0	0	0	3	1	4
		PPH	2	3	0	3	0	0	0	0	0	3	0
		FDPAC	2	2	0	1	1	0	0	0	0	1	1
		ACOL-MPSP	1	1	0	0	1	0	0	0	0	0	1

Table B.26 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TX (48)	SP-SS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	9	10	1	2	4	0	0	0	1	2	4
		PPH	3	5	0	1	0	0	0	0	0	1	0
		ASC-ACOL	4	4	2	0	2	0	0	0	2	0	2
		ASC	8	9	0	5	3	0	0	0	0	5	3
		SS	1	1	0	0	0	0	0	0	0	0	0
		MPP	4	4	1	1	1	0	0	0	1	1	1
		ACOL-STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		CS	3	3	1	0	2	0	0	0	1	0	2
	GA (13)	ACSR	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NC (37)	ACOL	2	2	1	1	0	0	0	0	1	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	2	1	0	0	0	0	0	1	0	0
		ACOL-SS	1	1	0	0	1	0	0	0	0	0	1
	SC (45)	ACOL	1	1	0	1	0	0	0	0	0	1	0
	SK (90)	ACOL	4	4	1	0	2	0	0	0	1	0	2
		ASC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	1	0	0	0	0	0	1	0
		MPSP	4	6	0	1	1	0	0	0	0	1	1
		ACSR	2	2	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0

Table B.26 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	CS	1	2	2	0	0	0	0	0	2	0	0
		ACSR-ACOL-FDPAC	1	1	1	0	0	0	0	0	1	0	0
	IN (18)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		CS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	1	0	0	0	0	0	1	0	0
	IA (19)	FDPAC-CS	1	1	0	1	0	0	0	0	0	1	0
		CS-FSC	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
	MN (27)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	0	0	0	0	0	0	0
	MO (29)	ACOL-SP	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
		CS-SP	1	1	0	0	1	0	0	0	0	0	1
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	4	1	0	1	0	0	0	1	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	1	0	1	0	0	0	1	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	1	0	0	0	0	0	1	0	0
		MPP	1	2	0	1	0	0	0	0	0	1	0

Table B.26 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		FDPAC-ACOL-LS-TS	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	1	0	0	0	0	0	1	0
	VA (51)	ACOL	5	10	4	1	4	0	0	0	4	1	4
		PPH	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-RACOL	1	1	1	0	0	0	0	0	0	0	0
	DC (11)	M&F	1	1	0	0	1	0	0	0	0	0	1
	ME (23)	ACSR-ACOL	2	2	2	0	0	0	0	0	2	0	0
		ACOL	1	1	1	0	1	0	0	0	1	0	0
		FDPAC	1	1	1	0	0	0	0	0	1	0	0
	VT (50)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		CS	2	2	2	0	0	0	0	0	2	0	0
	WV (54)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	1	0	0	0	0	0	1	0
	AB (81)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	MB (83)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	2	4	2	2	0	0	0	0	2	2	0
		ASC	2	4	0	0	2	0	0	0	0	0	2
	PQ (89)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.27 Summary of IRI data for GPS-6C test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-free	CO (8)	HSRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	CA (6)	CS	1	2	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	1	0	1	0	0	0	1	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
	DE (10)	CS	1	2	0	2	0	0	0	0	0	2	0
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	1	0	0	0	0	0	1	0
	FL (12)	ACSR-ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	RACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
	MS (28)	ACOL	1	2	1	1	0	0	0	0	1	1	0
	NC (37)	M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-FDPAC-RACOL	1	1	1	0	0	0	0	0	1	0	0
		STP-SS	1	1	0	0	1	0	0	0	0	0	1
		MPP	1	1	0	1	0	0	0	0	0	1	0
		ACSR	1	1	1	0	0	0	0	0	1	0	0
		RACOL	4	4	0	2	2	0	0	0	0	2	2
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	2	0	0	0	0	0	2	0	0
	OK (40)	ACOL	1	1	0	1	0	0	0	0	0	1	0
	TX (48)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		ASC	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	MD (24)	RACOL-ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
	PA (42)	CS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-RACOL	1	1	0	1	0	0	0	0	0	1	0
	VA (51)	RACOL	1	1	1	0	0	0	0	0	1	0	0
		STP	1	1	0	1	0	0	0	0	0	1	0

Table B.28 Summary of IRI data for GPS-6D test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	MA (25)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	1	0	0	0	0	0	1	0
	ON (87)	M&F	2	2	1	0	1	0	0	0	1	0	1
		STP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&F	2	2	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1

Table B.29 Summary of IRI data for GPS-6S test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	PPH	6	8	0	1	3	0	0	0	0	1	3
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&F	10	10	8	0	2	0	0	0	8	0	2
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		FSC	3	3	1	0	1	0	0	0	1	0	1
		ACSR-CS	1	1	0	0	1	0	0	0	0	0	1
		ACOL	1	1	1	0	0	0	0	0	1	0	0
		CS	3	5	0	1	2	0	0	0	0	1	2
		GS-PPH	1	1	0	0	0	0	0	0	0	0	0
		PPH-STSL	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
	CA (6)	M&F	2	2	1	0	1	0	0	0	1	0	1
		CS	2	2	0	1	0	0	0	0	0	1	0
		SP	1	1	0	1	0	0	0	0	0	1	0
	NM (35)	M&F	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PPH	1	2	0	2	0	0	0	0	0	2	0
		STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	1	0	0	0	0	0	1	0
	NV (32)	CS	1	2	1	1	0	0	0	0	1	1	0
		FSC	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	WY (56)	M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
	BC (82)	GS-RACOL-HSRAC	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0

Table B.29 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	M&FRAC	2	2	1	1	0	0	0	0	1	1	0
	AR (5)	MPSP	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACSR-MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-RACOL	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC-STSL	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	MPP	2	2	0	0	2	0	0	0	0	0	2
		ACOL	2	2	0	2	0	0	0	0	0	2	0
	KY (21)	M&F	1	1	1	0	0	0	0	0	1	0	0
	MD (24)	GS	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
	MS (28)	ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	2	2	0	0	0	0	0	0	0	0	0
		M&F	4	4	2	0	1	0	0	0	2	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0

Table B.29 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACSR-M&FRAC	2	3	1	1	0	0	0	0	1	1	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&F	2	2	2	0	0	0	0	0	2	0	0
		STP-SS	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	1	0	0	0	0	0	1	0	0
	OK (40)	FSC	1	4	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	M&F	1	1	1	0	0	0	0	0	1	0	0
	TN (47)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	0	1	1	0	0	0	0	1	1
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	FSC	1	2	0	0	0	0	0	0	0	0	0
		TC	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	3	1	2	0	0	0	0	1	2	0
		GS-ACOL-SC	1	1	0	1	0	0	0	0	0	1	0
		SP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	0	1	1	0	0	0	0	1	1
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	VA (51)	M&F	2	2	2	0	0	0	0	0	2	0	0

Table B.29 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
	KS (20)	PPH	1	1	1	0	0	0	0	0	1	0	0
		M&F	2	2	0	2	0	0	0	0	0	2	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
		SS	1	1	0	1	0	0	0	0	0	1	0
	ME (23)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
	MN (27)	PPH	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	3	3	2	1	0	0	0	0	2	1	0
		M&F	1	1	1	0	0	0	0	0	1	0	0
		CS	3	3	1	1	1	0	0	0	1	1	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		STSL	1	1	1	0	0	0	0	0	1	0	0
	NH (33)	ASC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	2	0	1	0	0	0	0	0	1	0

Table B.29 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	NJ (34)	ACOL	2	2	0	0	2	0	0	2	0	0	2
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	4	4	2	2	0	0	0	0	2	2	0
		MPSP	2	5	0	1	0	0	0	0	0	1	0
		PPH	2	2	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	1	0	0	0	0	0	1	0
	NY (36)	LS	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	CS	1	3	0	1	2	0	0	0	0	1	2
		PPH	1	1	0	0	1	0	0	0	0	0	1
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	VT (50)	CS	1	2	0	1	0	0	0	0	0	1	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	NB (84)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	ON (87)	M&F	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		RACOL	1	1	1	0	0	0	0	0	1	0	0

Table B.30 Summary of IRI data for GPS-7A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	M&F	1	1	1	0	0	0	0	0	1	0	0
		PPF	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	GA (13)	CS	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
		CS	1	2	0	1	0	0	0	0	0	1	0
	TX (48)	ASC	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IL (17)	M&F	2	2	2	0	0	0	0	0	2	0	0
		CS	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		FDPAC-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	KS (20)	PPH	1	1	0	0	0	0	0	0	0	0	0
		HSRAC	1	1	0	0	0	0	0	0	0	0	0
		SS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-RACOL	1	1	1	0	0	0	0	0	1	0	0

Table B.30 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	CS	1	1	0	0	1	0	0	0	0	0	1
	MS (28)	PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL-PCCOL	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	1	1	1	0	0	0	0	0	1	0	0
	NE (31)	M&FRAC	2	2	1	1	0	0	0	0	1	1	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		M&HRAC-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	1	0	0	0	0	0	1
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	OH (39)	FDPAC	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&FRAC	1	1	0	0	0	0	0	0	0	0	0
	RI (44)	PPH	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	1	0	0	0	0	0	1	0	0
	SD (46)	ASC	1	3	0	1	2	0	0	0	0	1	2
		CS	1	1	0	0	0	0	0	0	0	0	0
	ON (87)	CS-PPF	1	2	0	0	0	0	0	0	0	0	0

Table B.31 Summary of IRI data for GPS-7B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	WA (53)	ACOL	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	DE (10)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		CS	2	2	1	1	0	0	0	0	1	1	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL-FDPAC	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	1	0	0	0	0	0	1	0
	MS (28)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	1	3	0	2	1	0	0	0	0	2	1
		ACSR-PDPOJ	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASCR-ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	3	4	1	2	1	0	0	0	1	2	1
		SS	3	3	1	0	0	0	0	0	1	0	0
		SP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	2	0	0	0	0	0	0	0	0	0
		MPSP-CS	1	1	0	0	0	0	0	0	0	0	0
	NC (37)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
		ACSR-FDTJRP-PDPJ	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	VA (51)	GRS	1	1	1	0	0	0	0	0	1	0	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
	WV (54)	FDPOJ-PCCSR	1	1	0	1	0	0	0	0	0	1	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		FDPAC-PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.31 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	MPP	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	1	1	0	0	1	1	1	0
		CS	1	1	0	1	0	0	0	0	0	1	0
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		FDPOJ-ACOL	1	1	1	0	0	0	0	0	1	0	0
		PDPOJ-ACOL	1	1	0	0	1	0	0	0	0	0	1
	ID (16)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0
		CS	1	1	0	1	0	0	0	0	0	1	0
	IL (17)	FDPOJ	3	3	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
		ACOL	6	6	3	0	3	0	0	0	3	0	3
		CS	1	1	1	0	0	0	0	0	1	0	0
		MPP-FDPAC	2	2	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
	IN (18)	PDPJ	1	1	0	1	0	0	0	0	0	1	0
		ACOL	5	5	1	0	3	0	0	0	1	0	3
		CS	2	4	1	1	2	0	0	0	1	1	2
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	2	2	0	1	1	0	0	0	0	1	1
		FDPOJ	1	1	0	1	0	0	0	0	0	1	0
		FDPAC-M&F	1	1	1	0	0	0	0	0	1	0	0
		FDPAC-ACOL	1	1	1	0	0	0	0	0	1	0	0
	IA (19)	PDPJ	1	1	1	0	0	0	0	0	1	0	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		ACOL	4	4	1	0	2	0	0	0	1	0	2
		CS	2	2	1	0	1	0	0	0	1	0	1
		ASC	1	1	1	0	0	0	0	0	1	0	0
		FDPAC	1	2	1	1	0	0	0	0	1	1	0

Table B.31 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	KS (20)	ACOL	1	1	0	0	1	0	0	0	0	0	1
	MN (27)	ACOL	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	PDPJ	2	4	1	0	1	0	0	0	1	0	1
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	0	0	0	0
	OH (39)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		STSL	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	PA (42)	CS-TJS	1	1	1	0	0	0	0	0	1	0	0
		CS-LSJJS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL-SAS	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	1	0	1	0	0	0	1	0	1
		ACSR-ACOL-LS	1	1	0	1	0	0	0	0	0	1	0
		ACSR-RACOL-SAS	1	1	0	1	0	0	0	0	0	1	0
	VT (50)	CS	1	2	2	0	0	0	0	0	2	0	0
		FDPOJ-ACOL	1	1	1	0	0	0	0	0	1	0	0
	MB (83)	TJS-PDPJ	1	1	1	0	0	0	0	0	1	0	0
		ACOL	2	2	1	0	1	0	0	0	1	0	1
		CS	1	1	1	0	0	0	0	0	1	0	0
	PQ (89)	PPH	1	1	0	0	1	0	0	0	0	0	1
		PPH-FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-FDPOJ	2	2	0	0	0	0	0	0	0	0	0
		PPH-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0

Table B.32 Summary of IRI data for GPS-7C test sections

Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	2	2	2	0	0	0	0	0	2	0	0
		M&F	1	1	1	0	0	0	0	0	1	0	0
	TX (48)	ASC	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPOJ	1	1	0	0	1	0	0	0	0	0	1
		LSLJS	1	1	0	1	0	0	0	0	0	1	0

Table B.32 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	PDPOJ	1	2	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	KS (20)	LSLJS-PDPJ	1	1	1	0	0	0	0	0	1	0	0
		JLTR	1	1	0	1	0	0	0	0	0	1	0
		GS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	NC (37)	TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	1	0	0	0	0	0	1	0
	OH (39)	PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		HMRAC	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	2	0	1	0	0	0	0	0	1	0
		HMRAC-FDPOJ-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	PA (42)	ACSR-ACOL	2	2	0	2	0	0	0	0	0	2	0
		ACSR	1	1	1	0	0	0	0	0	1	0	0
		LSLJS	1	1	1	0	0	0	0	0	1	0	0
	PQ (89)	PDPJ-PDPOJ	1	5	1	2	1	0	0	0	1	2	1
		ACSR-PDPOJ	1	1	1	0	0	0	0	0	1	0	0
		CS-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	1	1	1	0	0	0	0	0	1	0	0
		RACOL-PDPOJ	1	1	1	0	0	0	0	0	1	0	0
		FT-M&F	1	1	1	0	0	0	0	0	1	0	0

Table B.33 Summary of IRI data for GPS-7D test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	ACOL-FT	2	2	2	0	0	0	0	0	2	0	0
		STSL	1	1	1	0	0	0	0	0	1	0	0

Table B.34 Summary of IRI data for GPS-9 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	PCCSR	2	2	0	1	0	0	0	0	0	1	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	1	0	0	0	0	0	1	0
		GS-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	PDPOJ	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	KS (20)	FDPOJ	1	1	0	1	0	0	0	0	0	1	0
	MI (26)	PDPJ-PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	MN (27)	PDPJ	1	2	0	1	1	0	0	0	0	1	1
		FDTJRP	1	1	1	0	0	0	0	0	1	0	0
	NE (31)	CS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
	OH (39)	PPH-PDPJ-PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		JTLR	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-GS	1	1	0	0	1	0	0	0	0	0	1
		PCCSR-OTHER	1	1	1	0	0	0	0	0	1	0	0
	PA (42)	GS	2	2	2	0	0	0	0	0	2	0	0
		ACSR-ACOL-LS	1	1	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	1	0	0	0	0	0	1

Table B.35 Summary of rut depth data for SPS-1 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry -no-freeze	AZ (4)	CS	6	9	4	3	2	0	0	0	4	3	2
		FDP	1	1	0	1	0	0	0	0	0	1	0
		PHP	1	1	1	0	0	0	0	0	1	0	0
		SS	6	6	4	0	2	0	0	0	4	0	2
	NM (35)	GS	2	2	0	2	0	0	0	2	2	0	0
	OK (40)	MPSP	1	1	1	0	0	0	0	0	1	0	0
		SP	12	12	0	0	12	0	0	0	0	0	12
	TX (48)	ACOL	12	12	0	2	0	0	0	0	0	2	0
		ASC	12	12	0	0	0	0	0	0	0	0	0
		GS	3	3	0	0	3	0	0	0	0	0	3
		MOAC-SR	12	12	12	0	0	0	0	0	12	0	0
		MPSP	10	10	0	10	0	0	0	0	0	10	0

Table B.35 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	KS (20)	CS	6	6	5	1	0	0	0	0	5	1	0
		CS-STP	1	1	1	0	0	0	0	0	1	0	0
		M&F	9	9	8	1	0	0	0	1	9	0	0
		PP	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	ASC	12	12	0	12	0	0	0	0	0	12	0
		CS	12	36	12	0	0	0	0	0	12	0	0
	NE (31)	GS	11	11	1	10	0	0	0	0	1	10	0
	NV (32)	CS	7	7	7	0	0	0	0	0	7	0	0
		FDP	1	1	1	0	0	0	0	0	1	0	0
		PPH	6	7	0	6	0	0	0	0	0	6	0
		SP	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	AL (1)	FDP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	AR (5)	CS	8	8	8	0	0	0	0	0	8	0	0
		FDP	2	2	0	0	2	0	2	0	2	0	0
		MPSP	3	3	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	2	0	2	0	2	0	0
		CS-MPSP	1	1	0	1	0	0	0	0	0	1	0
		CS-PPH	0	1	0	1	0	0	0	0	0	1	0

Table B.35 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	DE (10)	ACOL	12	12	0	0	12	0	0	0	0	0	12
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	IA (19)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		LS	6	6	0	0	6	0	0	0	0	0	6
		STP	12	12	12	0	0	0	0	0	12	0	0
	OH (39)	CS	1	1	0	0	0	0	0	0	0	0	0
		HMACR	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SR-MOAC	2	2	0	2	0	0	0	0	0	2	0
	MI (26)	CS	8	15	0	0	7	0	5	0	0	5	7
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
		MOAC	8	8	0	8	0	5	0	0	5	3	0
		SR-MOAC	8	8	0	8	0	0	0	0	0	8	0
	VA (51)	ACOL	11	11	0	11	0	0	0	0	0	11	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		STP	11	11	11	0	0	0	0	0	11	0	0

Table B.36 Summary of rut depth data for SPS-3 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	ACOL	4	4	0	0	4	0	0	0	0	0	4
		ASC	4	4	0	0	3	0	0	0	0	0	3
		CS	4	5	0	0	3	0	0	0	0	0	3
		MPP	4	4	1	1	1	0	0	0	1	1	1
		MPSP	2	2	0	0	0	0	0	0	0	0	0
		SS	4	4	0	0	2	0	0	0	0	0	2
	OK (40)	ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	ACOL	8	8	0	0	8	0	0	0	0	0	8
		ASC	8	8	0	0	6	0	0	0	0	0	6
		CS	16	18	0	5	1	0	0	0	0	5	1
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		CS-SP	2	2	0	0	0	0	0	0	0	0	0
		FDPAC	5	6	0	4	0	0	0	0	0	4	0
		FSC	1	1	0	0	1	0	0	0	0	0	1
		SP	7	16	0	1	0	0	0	0	0	1	0
		SS	8	8	0	0	6	0	0	0	0	0	6

Table B.36 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	7	3	2	2	0	0	0	3	2	2
		SS	1	1	0	0	1	0	0	0	0	0	1
	CO (8)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	3	0	0	2	0	0	0	0	0	2
		PPH	1	1	0	0	0	0	0	0	0	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
		SS	2	2	0	0	2	0	0	0	0	0	2
		STSL	1	1	0	1	0	0	0	0	0	1	0
	ID (16)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	3	0	0	0	0	0	3
		SS	3	3	0	0	3	0	0	0	0	0	3
	KS (20)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	6	8	0	6	2	0	0	0	0	6	2
		FDACP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	1	0	0	0	0	0	1	0	0
		STP	1	1	0	0	0	0	0	0	0	0	0
	MT (30)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1

Table B.36 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	NE (31)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	4	5	0	4	1	0	0	0	0	4	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	NV (32)	ACOL	3	3	0	0	2	0	0	0	0	0	2
		ASC	3	3	0	0	1	0	0	0	0	0	1
		CS	3	3	0	0	1	0	0	0	0	0	1
		MPSP	4	6	0	0	1	0	0	0	0	0	1
		SS	3	3	0	0	0	0	0	0	0	0	0
	UT (49)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	4	5	0	3	2	0	0	0	0	3	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	WA (53)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	3	0	0	1	0	0	0	0	0	1
		SS	2	2	0	0	2	0	0	0	0	0	2
	WY (56)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	SK (90)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	2	2	0	0	2	0	0	0	0	0	2
		FDPAC	2	3	0	2	1	0	0	0	0	2	1
		MPSP	3	7	0	1	0	0	0	0	0	1	0
		MPSP-ASC	1	1	0	0	0	0	0	0	0	0	0
		PPH	4	4	0	4	0	0	0	0	0	4	0
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.36 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACOL	3	3	0	0	3	0	0	0	0	0	3
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	5	6	0	4	1	0	0	0	0	4	1
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	10	0	2	0	0	0	0	0	2	0
		SS	3	3	0	0	3	0	0	0	0	0	3
	AR (5)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACOL	3	3	0	0	2	0	0	1	0	0	2
		ASC	3	3	0	0	3	0	0	0	0	0	3
		CS	3	3	0	0	2	0	0	0	0	0	2
		PPH	2	5	0	1	0	0	0	0	0	1	0
		SS	3	3	0	0	2	0	0	0	0	2	0
	OK (40)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	3	0	1	2	0	0	0	0	1	2
		MPP	3	4	0	2	0	0	0	0	0	2	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.36 (cont'd)

<table>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr>
<tr><td rowspan="3">Zone</td><td rowspan="3">State (code)</td><td colspan="2">Treatment data</td><td colspan="10">Number of treatment applications</td></tr>
<tr><td rowspan="2">Type</td><td rowspan="2">Number of sections</td><td rowspan="2">Total</td><td colspan="3">With 3 or more data points</td><td colspan="3">With one assigned data point after treatment (0.01 year)</td><td colspan="3">To be analyzed</td></tr>
<tr><td>BT & AT</td><td>BT only</td><td>AT only</td><td>BT & AT</td><td>BT only</td><td>AT only</td><td>BT & AT</td><td>BT only</td><td>AT only</td></tr>
<tr><td rowspan="18">Wet-no-freeze</td><td rowspan="8">TN (47)</td><td>ACOL</td><td>3</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>ASC</td><td>2</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>CS</td><td>4</td><td>8</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>FDPAC</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>PPH</td><td>2</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SS</td><td>1</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SS-CS</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>ASC-CS</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="10">TX (48)</td><td>ACOL</td><td>6</td><td>6</td><td>0</td><td>0</td><td>6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>6</td></tr>
<tr><td>SS</td><td>5</td><td>5</td><td>0</td><td>0</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>5</td></tr>
<tr><td>ASC</td><td>5</td><td>5</td><td>0</td><td>0</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>MPSP</td><td>4</td><td>4</td><td>0</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>CS</td><td>6</td><td>8</td><td>0</td><td>0</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>MPP</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>PPH</td><td>2</td><td>2</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>CS-SS</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>FDPAC</td><td>1</td><td>2</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>ASCR</td><td>4</td><td>4</td><td>0</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>4</td><td>0</td></tr>
</table>

Table B.36 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	ACOL	2	2	1	0	0	0	0	0	1	0	0
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	3	4	1	0	3	0	0	0	1	0	3
		LS-LJS	2	3	0	2	1	0	0	0	0	2	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	2	0	0	0	0	0	2
	IN (18)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
	KY (21)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-CS	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	2	0	0	0	0	0	2
		SS	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		SS	2	2	0	0	2	0	0	0	0	0	2

Table B.36(cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	ACOL	4	4	0	0	4	0	0	0	0	0	4
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	6	6	0	0	4	0	0	0	0	0	4
		MPSP	3	4	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		SS	4	4	0	0	4	0	0	0	0	0	4
	MN (27)	ACOL	3	3	0	0	2	0	0	0	0	0	2
		ASC	4	4	0	0	4	0	0	0	0	0	4
		CS	5	5	0	0	3	0	0	0	0	0	3
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	2	2	0	0	0	0	0	0	0	0	0
		SS	4	4	0	0	3	0	0	0	0	0	3
	MO (29)	ACOL	2	2	0	0	1	0	0	1	0	0	2
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	5	6	0	2	2	0	0	0	0	2	2
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		CS-STP	5	5	0	4	0	0	0	0	0	4	0
		CS-STP-SP	3	3	0	0	0	0	0	0	0	0	0
		MPSP	3	6	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	1	0	0	0	0	0	1
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	2	0	0	0	0	0	2
		CS	2	2	0	0	0	0	0	0	0	0	0
		MPP	2	2	0	0	0	0	0	0	0	1	0
		MPSP	3	3	1	0	2	0	0	0	1	0	2
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		MPSP-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	6	4	0	1	3	0	0	0	0	1	3
		SS	2	2	0	0	0	0	0	0	0	0	0
		STP	1	1	0	1	0	0	0	0	0	1	0

Table B.36 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ASCR	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	0	1	0	0	0	0	0	1
		CS	3	5	0	1	0	0	0	0	0	1	0
		CS-MPSP	1	1	0	0	0	0	0	0	0	0	0
		PPH	2	2	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
		STP	1	1	0	0	0	0	0	0	0	0	0
		MPSP	2	2	0	0	2	0	0	0	0	0	2
	ON (87)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	3	3	0	0	3	0	0	0	0	0	3
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SS	2	2	0	0	0	0	0	0	0	0	0
	PQ (89)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	0	0	0	0	0	0	0

Table B.37 Summary of rut depth data for SPS-5 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	CS	7	7	0	3	0	0	0	0	0	3	0
		FSC	8	19	9	3	7	0	1	0	9	3	7
		M&F	4	4	0	0	4	0	0	0	0	0	4
		M&FRAC	4	4	0	0	4	0	0	0	0	0	4
	CA (6)	CS	5	5	0	5	0	0	0	0	0	5	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		M&F	4	4	0	0	4	0	0	0	0	0	4
		M&FRAC	4	4	0	0	4	0	0	0	0	0	4
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		SP	2	2	1	1	0	0	0	0	1	1	0
		STSL	7	7	2	0	5	0	0	0	2	0	5
	OK (40)	MPSP-TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		MPSP-TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		SP	9	10	0	0	9	0	0	0	0	0	9
		TC-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ACSR-RACOL	1	1	0	0	0	0	0	0	0	0	0
		TC-ASR-M&F	2	2	0	0	0	0	0	0	0	0	0
		TC-ASR-M&FRAC	2	2	0	0	0	0	0	0	0	0	0
	NM (35)	ACOL	8	8	0	0	4	0	0	0	0	0	4
		ACOL-STSL	4	4	0	0	4	0	0	0	0	0	4
		CS	1	1	0	0	0	0	0	0	0	0	0
		GS	4	4	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PPH	4	4	1	1	0	0	0	0	1	1	0
		SP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		RACOL	3	3	0	0	0	0	0	0	0	0	0
		SP-RACOL	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.37 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AB (81)	ACSR-ACOL	2	2	0	0	1	0	0	0	0	0	1
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	6	6	3	1	1	0	0	0	3	1	1
		CS-PPH	3	3	3	0	0	0	0	0	3	0	0
		CS-TJS-PPH	1	1	1	0	0	0	0	0	1	0	0
		PPH	6	16	2	5	1	0	0	0	2	5	1
	CO (8)	ACOL-FSC	1	1	0	0	0	0	0	1	0	0	1
		ACOL-ACSR-FSC	2	2	0	0	0	0	0	2	0	0	2
		CS	9	9	2	7	0	0	0	0	2	7	0
		M&F-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
		M&FARC-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
		PPH	7	7	0	0	0	0	0	0	0	0	0
		RACOL-ACSR-FSC	2	2	0	0	2	0	0	0	0	0	2
	MT (30)	ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		CS	8	8	0	8	0	0	0	0	0	8	0
		M&F-ASC	8	8	7	0	1	0	0	0	7	0	1
		PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.37 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	MN (27)	ACOL	2	2	0	0	0	0	0	0	0	0	0
		CS	8	8	0	0	8	0	0	0	0	0	8
		M&FRAC	4	4	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		RACOL	2	2	0	0	0	0	0	0	0	0	0
		SP	9	20	7	9	2	0	0	0	7	9	2
	MB (83)	ACOL	1	1	0	0	0	0	0	1	0	0	1
		ASC	8	15	0	8	0	0	0	0	0	8	0
		CS	9	15	6	8	1	0	0	0	6	8	1
		M&F	2	2	0	0	0	0	0	2	0	0	2
		M&FRAC	2	2	0	0	0	0	0	2	0	0	2
		SP-ACOL	1	1	0	0	0	0	0	1	0	0	1
		MPP-ASC	1	1	0	0	1	0	0	0	0	0	1
		RACOL	3	3	0	0	0	0	0	3	0	0	3
Wet-no-freeze	AL (1)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	M & FRAC-ACSR	4	4	0	0	4	0	0	0	0	0	4
		M &F-ACSR	4	4	0	0	4	0	0	0	0	0	4
	MS (28)	MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2

Table B.37 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MA (23)	ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		CS	9	9	0	8	0	0	0	0	0	8	0
		M&F-ACSR	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC-ACSR	2	2	0	0	2	0	0	0	0	0	2
		PPH	1	1	0	1	0	0	0	0	0	1	0
		RACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
	GA (13)	M & FRAC-ACSR	3	3	0	0	3	0	0	0	0	0	3
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		M &F-ACSR	3	3	0	0	3	0	0	0	0	0	3
	NJ (34)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPAC	1	1	0	0	1	0	0	0	0	1	0
		MPSP	2	2	2	0	0	0	0	0	0	0	2
		PPH	2	2	1	0	1	0	0	0	1	0	1

Table B.37 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&F	2	2	0	0	2	0	0	0	0	0	2
		ACSR-M&FRAC	2	2	0	0	2	0	0	0	0	0	2
		ACSR-RACOL	2	2	0	0	2	0	0	0	0	0	2
	MD (24)	MPP-CS	1	1	0	0	0	0	0	0	1	0	0
		ACSR-RACOL	1	1	1	0	0	0	0	0	1	0	0
		FDPAP	2	2	2	0	0	0	0	0	2	0	0
		M&F	2	2	2	0	0	0	0	0	2	0	0
		MPP	4	4	0	3	1	0	0	0	0	3	1
		MPP-ACSR_ACOL	2	2	2	0	0	0	0	0	2	0	0
		MPP-ACSR-HSRAC	1	1	1	0	0	0	0	0	1	0	0
		MPP-ACSR-M&FRAC	2	2	2	0	0	0	0	0	2	0	0
		MPP-ACSR-MPP	2	2	2	0	0	0	0	0	2	0	0

Table B.38 Summary of rut depth data for SPS-6 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AZ (4)	PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GRS-TJS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS-FDTJRP-PDPOJ-SR	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		ACOL	4	4	0	0	0	0	0	4	0	0	4
		SAS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	1	0	0	1
		FT	2	2	0	0	0	0	0	0	0	0	0
		CS	5	5	0	0	4	0	5	0	4	1	0
		PPH	3	3	0	2	1	0	0	0	0	2	1
		SP	1	1	1	0	0	0	0	0	1	0	0
	CA (6)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-LS-ACOL	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SAS-ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	5	10	3	4	1	0	0	0	3	4	1
		FDPAC	4	5	2	2	1	0	0	0	2	2	1
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ-SR-LS	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT	1	1	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	1	1	0	0	0	0	1	1
		TJS	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	1	0	0	0	0	0	1	0

Table B.38 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	SD (46)	ACOL-FDTJRP-PCCSR	2	2	0	0	0	0	0	0	0	0	0
		ACSR	4	4	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SSC	1	1	0	0	0	0	0	0	0	0	0
		ASC	4	4	1	3	0	0	0	0	0	1	3
		ASC-SAS	1	1	1	0	0	0	0	0	1	0	0
		FTP-ACOL	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PGS-ACOL-LS-JLTR-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PPH	3	4	0	0	0	0	0	0	0	0	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
		SSC-SAS	4	4	0	0	4	0	0	0	0	0	4
Wet-no-freeze	AL (1)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	4	4	0	0	3	0	0	0	0	0	3
		JLTR-FDTJRP-LS	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	3	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
	AK (5)	ACSR-ACOL	3	3	0	0	3	0	0	0	0	0	3
		CS-TJS-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FT	2	2	0	0	0	0	0	0	0	0	0
		JLTR-CS-TJS-FDPOJ-PDPOJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LS	2	2	0	0	0	0	0	0	0	0	0
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1

Table B.38 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data: Type	Treatment data: Number of sections	Number of treatment applications: Total	With 3 or more data points: BT & AT	With 3 or more data points: BT only	With 3 or more data points: AT only	With one assigned data point after treatment (0.01 year): BT & AT	With one assigned data point after treatment (0.01 year): BT only	With one assigned data point after treatment (0.01 year): AT only	To be analyzed: BT & AT	To be analyzed: BT only	To be analyzed: AT only
Wet-no-freeze	OK (40)	ACOL-ACSR	1	1	0	0	0	0	0	1	0	0	1
		ACOL-ACSR-SAS	1	1	0	0	0	0	0	1	0	0	1
		CS	5	6	1	0	4	0	1	0	1	1	4
		FDTJRP	3	3	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	0	0	0	1	0	0	1
		LS-FTP-ACOL	1	1	0	0	0	0	0	1	0	0	1
		LS-FTP-ACOL-ACSR	1	1	0	0	0	0	0	1	0	0	1
		M&F	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SSC	1	1	0	0	0	0	0	0	0	0	0
	TN (47)	FTP-FDTJRP-PCCSR-ACSR-ACOL-LS	2	2	0	0	1	0	0	0	0	0	1
		FDTJRP-PCCSR-ACSR-ACOL-LS	1	1	0	0	0	0	0	1	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		GS-FDTJRP-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	3	0	1	1	0	0	0	0	1	1
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IL (17)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	0	0	0	0	0	0	0
		CS	4	4	3	1	0	0	0	0	3	1	0
		CS-SP	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	2	3	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PGS-LS	1	1	0	0	0	0	0	0	0	0	0
		FT-ACOL-ACSR	2	2	0	0	2	0	0	0	0	0	2
		LS	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	2	0	0	0	0	0	0	0	0	0
		PPH	2	3	1	1	1	0	0	0	1	1	1
		SP	5	11	1	5	2	0	0	0	1	5	2
		TJS-ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1

Table B.38 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	ACSR-ACOL	4	4	0	0	4	0	0	0	0	0	4
		ACSR-ACOL-SAS	1	1	0	0	1	0	0	0	0	0	1
		CS	5	9	1	4	4	0	0	0	1	4	4
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		SP	5	5	0	4	0	0	0	0	0	4	0
	IA (19)	ACOL	3	3	0	0	0	0	0	0	0	0	0
		ACOL-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACOL-LS-JLTR-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS	5	5	0	0	5	0	0	0	0	0	5
		FDPAC	4	5	2	2	1	0	0	0	2	2	1
		LS	2	2	1	1	0	0	0	0	1	1	0
		LS-FT	2	2	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	0	0	0	0	0	0	0
		SP	5	5	0	3	0	0	0	0	0	3	0
		TJS-FDTJRP	1	1	1	0	0	0	0	0	1	0	0
	MI (26)	ACOL-FDTJRP-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		ACOL-TJS-FDTJRP-PDPJ-SAS	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-ACOL-LS	1	1	0	0	1	0	0	0	0	0	1
		ACOL-FT	2	2	0	0	2	0	0	0	0	0	2
		PDPJ	1	1	1	0	0	0	0	0	1	0	0

Table B.38 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	CS	2	2	2	0	0	0	0	0	2	0	0
		CS-MPSP	1	1	1	0	0	0	0	0	1	0	0
		FDPAC	1	2	0	0	0	0	0	0	0	0	0
		FDTJRP-ACOL	2	2	0	0	1	0	0	0	0	0	1
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		LS-FT-ACOL	1	1	0	0	0	0	0	1	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		SAS	1	1	0	0	1	0	0	0	0	0	1
		SP	3	3	0	2	0	0	0	0	0	2	0
	MO (29)	FDTJRP	2	2	0	0	0	0	0	0	0	0	0
		PGS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-FT-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		SAS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		LS-ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		CS	4	4	4	0	0	0	0	0	4	0	0
	PA (42)	ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ACSR-SAS	1	1	0	0	1	0	0	0	0	0	1
		JLTR-FDTJRP-PCCSR-PGS-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		JLTR-FDTJRP-PDPOJ-LS	1	1	0	0	0	0	0	0	0	0	0
		LS-ACOL-ACSR	1	1	0	0	1	0	0	0	0	0	1
		LS-FTP-ACOL-LS	2	2	0	0	2	0	0	0	0	0	2
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0

Table B.39 Summary of rut depth data for GPS-6A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	CS	1	1	0	0	0	0	0	0	0	0	0
		GS	1	1	0	0	0	0	0	0	0	0	0
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	0	1	1	0	0	0	0	1	1
		PPF-FSC	2	2	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		SSC	1	1	1	0	0	0	0	0	1	0	0
	NM (35)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACOL-M&FCRAC	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	2	0	1	0	0	0	0	0	1	0
		SSC	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		PPH	3	3	0	2	0	0	0	0	0	2	0
		STP	1	2	0	0	0	0	0	0	0	0	0
		CS-STP	1	1	0	0	0	0	0	0	0	0	0
		M&F	2	2	2	0	0	0	0	0	2	0	0
		CS	2	2	1	0	0	0	0	0	1	0	0
	MT (30)	CS-ACOL-ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	1	0	0	0	0	0	1	0
		ASC	1	2	0	1	1	0	0	0	0	1	1
	SD (46)	CS	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	2	0	1	1	0	0	0	0	1	1

Table B.39 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	TX (48)	CS	1	2	1	0	1	0	0	0	1	0	1
		PPH	1	5	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	0	0	0	1	0	0	1
		CS-FSC	1	1	0	1	0	0	0	0	0	1	0
		ASC	2	2	0	1	1	0	0	0	0	1	1
	UT (49)	M&F-ASC	1	1	0	1	0	0	0	0	0	1	0
	WA (53)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		RACOL	1	1	0	0	0	0	0	1	0	0	1
		PPH	2	3	0	2	0	0	0	0	0	2	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		M&F-ACOL	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	WY (56)	CS	2	2	0	2	0	0	0	0	0	2	0
		ACOL	2	3	0	1	0	0	0	0	0	1	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0

Table B.39 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPAC	1	1	1	0	0	0	0	0	1	0	0
		FSC	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	1	0	0	0	0	0	1	0	0
	OR (41)	MPP	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	TN (47)	PPH	1	1	0	0	0	0	0	0	0	0	0
	BC (82)	ACOL	1	1	0	0	1	0	1	0	1	0	0
		CS	2	2	0	2	0	0	0	0	0	2	0
		HSSRAC	1	1	0	1	0	0	0	1	1	0	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	AK (2)	CS	1	1	0	1	0	0	0	0	0	1	0
	IN (18)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		ACSR-M&F	1	1	0	1	0	0	0	0	0	1	0
	IA (19)	CS	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	1	0	0	0	0	0	1	0	0
		MPP-STP	1	1	0	1	0	0	0	0	0	1	0
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
	KS (20)	ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		ASC	2	2	0	2	0	0	0	0	0	2	0
		ACOL	1	1	0	1	0	0	0	1	1	0	0
		M&FRAC	1	1	0	0	1	0	1	0	1	0	0
		M&F	1	1	0	0	0	0	0	0	0	0	0

Table B.39 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MN (27)	ACSR-M&FRAC-ACOL-CS	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
		SS	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	ACSR	1	1	1	0	0	0	0	0	1	0	0
	AB (81)	CS	1	1	1	0	0	0	0	0	1	0	0
		CS-FDPAC	1	1	1	0	0	0	0	0	1	0	0
	NB (84)	M&F	1	2	2	0	0	0	0	0	2	0	0
	NS (86)	MPSP	1	2	0	0	2	0	0	0	0	0	2
		M&F	1	1	0	0	0	0	0	1	0	0	1
		STP	1	1	0	0	0	0	0	0	0	0	0
	SK (90)	ASC	1	1	1	0	1	0	0	0	0	1	0
		MPP	1	1	1	0	0	0	0	0	1	0	0
		SP	1	1	0	0	1	0	0	0	0	0	1

Table B.40 Summary of rut depth data for GPS-6B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	ACOL	2	3	0	2	0	0	0	2	2	0	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		SP	1	1	0	0	1	0	0	0	0	0	1
	ID (16)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
		STSL	1	1	1	0	0	0	0	0	1	0	0
	MT (30)	M&F	2	3	1	1	0	0	0	2	2	0	1
		M&F-ASC	2	2	2	0	0	0	0	0	2	0	0
		CS	3	3	0	2	1	0	0	0	0	2	1
		ASC	2	2	0	0	1	0	1	0	1	0	0
		ACSR-ACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	1	0	0	0	0	0	1	0	0
	WA (53)	ACOL	3	4	0	0	3	0	0	1	0	0	4
		M&F	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	0	0	1	0	1	0	1	0	0
		PPH	2	2	0	2	0	0	0	0	0	2	0
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	SD (46)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	0	0	0	2	0	0	2
		ASC	1	1	1	0	0	0	0	0	0	0	0
		ACOL-ASC	1	1	0	0	0	0	0	0	0	1	0
	WY (56)	ACOL	4	4	0	2	0	0	0	0	0	2	0
		ASC	4	6	0	0	4	0	0	0	0	0	4
		CS	1	1	1	0	0	0	0	0	1	0	0
		ACOL-FSC	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.40 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		ASC-ACOL	1	1	0	0	1	0	0	0	0	0	1
	AR (5)	ACOL	1	1	1	0	0	0	0	0	1	0	0
	CA (6)	CS-MPP-ACOL	1	1	1	0	0	0	0	0	1	0	0
		ACOL	9	13	4	3	4	0	0	1	5	2	4
		ACOL-GS	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	2	2	0	0	0	0	0	2	0	0
		CS	3	3	1	2	0	0	0	0	1	2	0
		CS-FDPAC-PPH	1	1	0	1	0	0	0	0	0	1	0
		CS-MPP	1	1	0	1	0	0	0	0	0	1	0
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		SS	1	1	0	0	0	0	0	0	0	0	0
		STSL	1	1	1	0	0	0	0	0	1	0	0
	FL (12)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	3	3	0	0	0	0	0	0	0	0	0
		STSL	3	3	0	0	3	0	0	0	0	0	3
	MS (28)	M&F	1	1	0	0	1	0	0	0	0	0	1
	OK (40)	ACOL	3	3	3	0	0	0	0	0	3	0	0
		ACOL-CS-FSC	1	1	0	0	1	0	0	0	0	0	1
		CS	2	2	1	0	1	0	0	0	1	0	1
	TN (47)	CS	3	3	2	0	1	0	0	0	2	0	1
		ACOL	7	8	3	0	5	0	0	0	3	0	5
		PPH	2	3	0	3	0	0	0	0	0	3	0
		FDPAC	2	2	0	1	0	0	0	0	0	1	0
		ACOL-MPSP	1	1	0	0	1	0	0	0	0	0	1

Table B.40 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TX (48)	SP-SS	1	1	0	0	0	0	0	0	0	0	0
		PPH	3	5	0	1	0	0	0	0	0	1	0
		ACOL	9	10	1	1	2	0	0	0	1	1	2
		ASC-ACOL	4	4	3	0	1	0	0	0	3	0	1
		ASC	8	9	1	5	3	0	0	0	1	5	3
		SS	1	1	0	0	1	0	0	0	0	0	1
		MPP	4	4	2	1	0	0	0	0	2	1	0
		ACOL-STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	1	0	1	0	1	0	0
		STP	1	1	0	1	0	0	0	0	0	1	0
		CS	3	3	2	0	1	0	0	0	2	0	1
	GA (13)	ACSR	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NC (37)	ACOL	2	2	1	1	0	0	0	0	1	1	0
		MPSP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	2	1	0	1	0	0	0	1	0	1
		ACOL-SS	1	1	0	0	1	0	0	0	0	0	1
	SC (45)	ACOL	1	1	1	0	0	0	0	0	1	0	0
	SK (90)	ACOL	4	4	0	0	2	0	0	0	0	0	2
		ASC	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	1	0	0	0	0	0	1	0
		MPSP	4	6	0	1	2	0	0	0	0	1	2
		ACSR	2	2	0	2	0	0	0	0	0	2	0
		PPH	1	1	1	0	0	0	0	0	1	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0

Table B.40 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	CS	1	2	0	1	1	0	0	0	0	1	1
		ACSR-ACOL-FDPAC	1	1	1	0	0	0	0	0	1	0	0
	IN (18)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		CS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		SSC	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	1	0	0	0	0	0	1	0	0
	IA (19)	FDPAC-CS	1	1	0	1	0	0	0	0	0	1	0
		CS-FSC	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
	MN (27)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACOL-SP	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
		CS-SP	1	1	0	0	1	0	0	0	0	0	1
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	4	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	0	0	0	0	0	0	0
		STSL	1	1	0	0	1	0	0	0	0	0	1
	NY (36)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	1	0	1	0	0	0	1	0	1
		CS	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	2	0	0	0	0	0	0	0	0	0

Table B.40 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	PA (42)	ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
		FDPAC-ACOL-LS-TS	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
	VI (51)	ACOL	5	10	3	3	4	0	0	0	3	3	4
		PPH	1	1	0	1	0	0	0	0	0	1	0
		MPSP	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL	1	1	1	0	0	0	0	0	1	0	0
	DC (11)	M&F	1	1	0	0	1	0	0	0	0	0	1
	ME (23)	ACSR-ACOL	2	2	2	0	0	0	0	0	2	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
	VT (50)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		CS	2	2	2	0	0	0	0	0	2	0	0
	WV (54)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
	AB (81)	ACOL	2	2	1	0	1	0	0	0	1	0	1
		ACSR	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	MB (83)	ACOL	2	2	0	0	0	0	0	2	0	0	2
		CS	2	4	0	2	2	0	2	0	2	2	0
		ASC	2	4	0	0	0	0	0	0	0	0	0
	PQ (89)	ACOL	2	2	2	0	0	0	0	0	2	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.41 Summary of rut depth data for GPS-6C test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	HSRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-no-freeze	CA (6)	CS	1	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	1	0	1	0	0	0	1	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
	DE (10)	CS	1	2	0	2	0	0	0	0	0	2	0
		ACSR-RACOL	1	1	0	0	1	0	0	0	0	0	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
	FL (12)	ACSR-ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	RACOL-ASC	1	1	1	0	0	0	0	0	1	0	0
	MS (28)	ACOL	1	2	1	1	0	0	0	0	1	1	0
	NC (37)	M&F	1	1	0	0	1	0	0	0	0	0	1
		ACSR-FDPAC-RACOL	1	1	1	0	0	0	0	0	1	0	0
		STP-SS	1	1	0	0	0	0	0	0	0	0	0
		MPP	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	1	0	0	0	0	0	1	0	0
		RACOL	4	4	1	0	3	0	0	0	1	0	3
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	2	0	0	0	0	0	2	0	0
	OK (40)	ACOL	1	1	1	0	0	0	0	0	1	0	0
	TX (48)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	MD (24)	RACOL-ACSR-ACOL	1	1	1	0	0	0	0	0	1	0	0
	PA (42)	CS	1	1	1	0	0	0	0	0	1	0	0
		ACSR-RACOL	1	1	0	1	0	0	0	0	0	1	0
	VA (51)	RACOL	1	1	1	0	0	0	0	0	1	0	0
		STP	1	1	0	1	0	0	0	0	0	1	0

Table B.42 Summary of rut depth data for GPS-6D test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data			Number of treatment applications								
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	MA (25)	ACOL	1	1	0	0	1	0	1	0	1	0	0
		M&F	1	1	0	1	0	0	0	1	1	0	0
	ON (87)	M&F	2	2	1	1	0	0	0	0	1	1	0
		STP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&F	2	2	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	0	0	0	0	0	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1

Table B.43 Summary of rut depth data for GPS-6S test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	PPH	6	8	0	1	0	0	0	0	0	1	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&F	10	10	4	0	5	0	1	0	5	0	4
		CS-PPH	1	1	0	0	1	0	0	0	0	0	1
		FSC	3	3	0	0	1	0	0	0	0	0	1
		ACSR-CS	1	1	0	0	1	0	0	0	0	0	1
		ACOL	1	1	1	0	0	0	0	0	1	0	0
		CS	3	5	0	1	1	0	0	0	0	1	1
		GS-PPH	1	1	0	0	0	0	0	0	0	0	0
		PPH-STSL	1	1	0	0	0	0	0	1	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
	CA (6)	M&F	2	2	2	0	0	0	0	0	2	0	0
		CS	2	2	0	1	0	0	0	0	0	1	0
		SP	1	1	0	1	0	0	0	0	0	1	0
	NM (35)	M&F	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PPH	1	2	0	2	0	0	0	0	0	2	0
		STSL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ASC	1	1	0	1	0	0	0	0	0	1	0
	NV (32)	CS	1	2	1	1	0	0	0	0	1	1	0
		FSC	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	WY (56)	M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
	BC (82)	GS-RACOL-HSRAC	1	1	1	0	0	0	0	0	1	0	0
		ASC	1	1	1	0	0	0	0	0	1	0	0

Table B.43 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	M&FRAC	2	2	2	0	0	0	0	0	2	0	0
	AR (5)	MPSP	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	FL (12)	ACSR-MPSP	1	1	0	1	0	0	0	0	0	1	0
		ACSR-RACOL	1	1	0	1	0	0	0	1	1	0	0
		ACSR-M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC-STSL	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	GA (13)	MPP	2	2	0	0	2	0	0	0	0	0	2
		ACOL	2	2	2	0	0	0	0	0	2	0	0
	KY (21)	M&F	1	1	1	0	0	0	0	0	1	0	0
	MD (24)	GS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
	MS (28)	ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PPH	2	2	0	1	0	0	0	0	0	1	0
		M&F	4	4	2	0	1	0	0	0	2	0	1
		FDPAC	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0

Table B.43 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	NC (37)	ACSR-M&FRAC	2	3	1	1	0	0	0	0	1	1	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		M&F	2	2	2	0	0	0	0	0	2	0	0
		STP-SS	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
		STSL	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	1	0	0	0	0	0	1	0	0
	OK (40)	FSC	1	4	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	M&F	1	1	0	0	1	0	0	0	0	0	1
	TN (47)	ACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	0	1	1	0	0	1	1	0	1
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	FSC	1	2	0	2	0	0	0	0	0	2	0
		TC	1	1	0	0	1	0	0	0	0	0	1
		ASC	2	2	0	1	0	0	0	0	0	1	0
		GS-ACOL-SC	1	1	0	0	1	0	0	0	0	0	1
		SP	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	2	2	0	2	0	0	0	2	2	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	VA (51)	M&F	2	2	2	0	0	0	0	0	2	0	0

Table B.43 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	M&FRAC	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	KS (20)	PPH	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	KS (20)	M&F	2	2	0	2	0	0	0	0	0	2	0
Wet-freeze	KS (20)	ACOL	1	1	0	0	0	0	0	1	0	0	1
Wet-freeze	KS (20)	ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	RACOL	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	KS (20)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	KS (20)	SS	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	ME (23)	ACSR-M&F	1	1	1	0	0	0	0	0	1	0	0
Wet-freeze	MN (27)	PPH	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	MN (27)	M&FRAC	3	3	1	1	1	0	1	1	3	0	0
Wet-freeze	MN (27)	M&F	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	MN (27)	CS	3	3	1	0	2	0	2	0	3	0	0
Wet-freeze	MN (27)	ASC	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	MN (27)	STSL	1	1	0	0	0	0	0	1	0	0	1
Wet-freeze	NH (33)	ASC	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	NH (33)	CS	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	NH (33)	M&F	1	1	0	0	0	0	0	0	0	0	0
Wet-freeze	NH (33)	FDPAC	1	2	0	1	0	0	0	0	0	1	0

Table B.43 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	NJ (34)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	4	4	2	2	0	0	0	0	2	2	0
		MPSP	1	5	0	1	0	0	0	0	0	1	0
		PPH	2	2	0	1	0	0	1	0	0	2	0
		STSL	1	1	0	1	0	0	0	1	1	0	0
	NY (36)	LS	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	CS	1	2	0	1	1	0	0	0	0	1	1
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	0	1	0	0	0	0	0	1
	VT (50)	CS	1	2	2	0	0	0	0	0	2	0	0
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	NB (84)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	ON (87)	M&F	1	1	1	0	0	0	0	0	1	0	0
		M&FRAC	1	1	1	0	0	0	0	0	1	0	0
		RACOL	1	1	1	0	0	0	0	0	1	0	0

Table B.44 Summary of rut depth data for GPS-7A test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CO (8)	M&F	1	1	1	0	0	0	0	0	1	0	0
		PPF	1	1	0	1	0	0	0	0	0	1	0
Wet-no-freeze	GA (13)	CS	1	1	0	1	0	0	0	0	0	1	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
		CS	1	2	1	1	0	0	0	0	1	1	0
	TX (48)	ASC	1	1	0	0	0	0	0	0	0	0	0
		M&F	1	1	0	0	1	0	0	0	0	0	1
		SS	1	1	0	0	1	0	0	0	0	0	1
Wet-freeze	IL (17)	M&F	2	2	1	1	0	0	0	1	2	0	0
		CS	1	1	0	0	0	0	1	0	0	1	0
		PPH	1	1	0	1	0	0	0	0	0	1	0
		FDPAC-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	1	0	0	0	0	0	1	0
	KS (20)	PPH	1	1	0	0	0	0	0	0	0	0	0
		HSRAC	1	1	0	0	0	0	0	0	0	0	0
		SS	1	1	0	0	0	0	0	0	0	0	0
		ACSR-RACOL	1	1	0	1	0	0	0	1	1	0	0

Table B.44 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MI (26)	CS	1	1	0	0	1	0	0	0	0	0	1
	MS (28)	PPH	1	1	0	1	0	0	0	0	0	1	0
		ACOL-PCCOL	1	1	0	0	0	0	0	1	0	0	1
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	M&FRAC	2	2	1	1	0	0	0	0	1	1	0
		ASC	1	1	0	1	0	0	0	0	0	1	0
		M&FRAC-ACOL	1	1	0	0	1	0	0	0	0	0	1
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		CS	1	2	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	OH (39)	FDPAC	1	1	0	1	0	0	0	0	0	1	0
		ACSR-M&FRAC	1	1	0	0	1	0	0	0	0	0	1
	RI (44)	PPH	1	1	1	0	0	0	0	0	1	0	0
		M&F	1	1	1	0	0	0	0	0	1	0	0
	SD (46)	ASC	1	3	0	1	2	0	0	0	0	1	2
		CS	1	1	0	0	0	0	0	0	0	0	0
	ON (87)	CS-PPF	1	2	1	1	0	0	0	0	0	1	1

Table B.45 Summary of rut depth data for GPS-7B test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	WA (53)	ACOL	1	1	0	1	0	0	0	0	0	1	0
Wet-no-freeze	DE (10)	ACOL	1	1	1	0	0	0	0	0	1	0	0
		CS	2	2	1	1	0	0	0	0	1	1	0
		ACSR-ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL-FDPAC	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	1	0	0	0	0	0	1	0
	MS (28)	ACOL	2	2	0	0	1	0	0	0	0	0	1
		PDPOJ	1	3	0	2	1	0	0	0	0	2	1
		ACSR-PDPOJ	1	1	0	0	1	0	0	0	0	0	1
	MO (29)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		ASCR-ACOL	2	2	0	0	1	0	0	0	0	0	1
		CS	3	4	1	2	0	0	0	0	1	2	0
		SS	3	3	0	1	0	0	0	0	0	1	0
		SP	1	1	0	0	0	0	0	0	0	0	0
		PPH	1	2	0	0	0	0	0	0	0	0	0
		MPSP-CS	1	1	0	0	0	0	0	0	0	0	0
	NC (37)	ACOL	2	2	1	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	1	0	0	0	0	0	1
		ACSR-FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	1	0	0	0	0	0	1
	VA (51)	GRS	1	1	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
	WV (54)	FDPOJ-PCCSR	1	1	0	1	0	0	0	0	0	1	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		M&FRAC-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		FDPAC-PPH	1	1	0	1	0	0	0	0	0	1	0

Table B.45 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	CT (9)	MPP	1	1	0	0	0	0	0	0	0	0	0
		ACOL	2	3	0	1	0	0	0	0	0	1	1
		CS	1	1	0	0	0	0	0	0	0	0	0
		MPSP-PPH	1	2	0	0	0	0	0	0	0	0	0
		FDPOJ-ACOL	1	1	1	0	0	0	0	0	1	0	0
		PDPOJ-ACOL	1	1	0	0	0	0	0	0	0	0	0
	ID (16)	ACOL	1	1	0	0	0	0	0	0	0	0	0
		ASC	1	1	0	0	1	0	0	0	0	0	1
		CS	1	1	0	1	0	0	0	0	0	1	0
	IL (17)	FDPOJ	3	3	0	2	0	0	0	0	0	2	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	6	6	1	1	4	0	0	0	1	1	4
		CS	1	1	0	0	1	0	0	0	0	0	1
		MPP-FDPAC	2	2	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&F	1	1	0	0	1	0	0	0	0	0	1
	IN (18)	PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	5	5	1	0	3	0	0	0	1	0	3
		CS	2	4	0	0	1	0	0	0	0	0	1
		FDPAC	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	2	2	0	0	1	0	0	0	0	0	2
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDPAC-M&F	1	1	1	0	0	0	0	0	1	0	0
		FDPAC-ACOL	1	1	1	0	0	0	0	0	1	0	0
	IA (19)	PDPJ	1	1	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	4	4	1	0	2	0	0	0	1	0	2
		CS	2	2	0	1	1	0	0	0	0	1	1
		ASC	1	1	0	0	1	0	0	0	0	0	1
		FDPAC	1	2	1	1	0	0	0	0	1	1	0

Table B.45 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	KS (20)	ACOL	1	1	0	0	1	0	0	0	0	0	1
	MN (27)	ACOL	1	1	0	0	1	0	0	0	0	0	1
	NE (31)	PDPJ	2	4	0	1	0	0	0	0	0	1	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	1	0	0	0	0	0	1	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	OH (39)	ACOL	2	2	0	0	2	0	0	0	0	0	2
		STSL	1	1	0	1	0	0	0	0	0	1	0
		PPH	1	1	0	0	0	0	0	0	0	0	0
		ACSR-M&FRAC	1	1	0	1	0	0	0	0	0	1	0
	PA (42)	CS-TJS	1	1	1	0	0	0	0	0	1	0	0
		CS-LSJJS	1	1	0	0	1	0	0	0	0	0	1
		ACSR-ACOL	2	2	0	0	2	0	0	0	0	0	2
		ACSR-ACOL-SAS	1	1	0	0	0	0	0	1	0	0	1
		GS	1	1	0	1	0	0	0	0	0	1	0
		ACSR-ACOL-LS	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
		ACSR-RACOL-SAS	1	1	0	1	0	0	0	0	0	1	0
	VT (50)	CS	1	2	2	0	0	0	0	0	2	0	0
		FDPOJ-ACOL	1	1	0	0	1	0	0	0	0	0	1
	MB (83)	TJS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		CS	1	1	0	1	0	0	0	0	0	1	0
	PQ (89)	PPH	1	1	0	0	1	0	0	0	0	0	1
		PPH-FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-FDPOJ	2	2	0	0	0	0	0	0	0	0	0
		PPH-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0

Table B.46 Summary of rut depth data for GPS-7C test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
	OR (41)	ACOL	1	1	0	1	0	0	0	0	0	1	0
		RACOL	2	2	0	0	2	0	0	0	0	0	2
		M&F	1	1	0	1	0	0	0	0	0	1	0
	TX (48)	ASC	1	1	0	1	0	0	0	0	0	1	0
		ACOL	2	2	0	0	2	0	0	0	0	0	2
		FDPOJ	1	1	0	0	1	0	0	0	0	0	1
		LSLJS	1	1	0	1	0	0	0	0	0	1	0

Table B.46 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
		Treatment data		Number of treatment applications									
Zone	State (code)	Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IL (17)	PDPOJ	1	2	0	1	0	0	0	0	0	1	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL	1	1	0	0	1	0	0	0	0	0	1
	KS (20)	LSLJS-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		JLTR	1	1	0	0	0	0	0	0	0	0	0
		GS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		ACOL-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	NC (37)	TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&F	1	1	0	1	0	0	0	0	0	1	0
	OH (39)	PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		RACOL	1	1	0	0	1	0	0	0	0	0	1
		M&FRAC	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	2	0	1	0	0	0	0	0	1	0
		RACOL-FDPOJ-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	PA (42)	ACSR-ACOL	2	2	0	0	0	0	0	0	0	0	0
		ACSR	1	1	0	1	0	0	0	0	0	1	0
		LSLJS	1	1	0	1	0	0	0	0	0	1	0
	PQ (89)	PDPJ-PDPOJ	1	5	0	0	0	0	0	0	0	0	0
		ACSR-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		RACOL-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FT-M&F	1	1	1	0	0	0	0	0	1	0	0

Table B.46 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	ACOL-FT	2	2	1	0	1	0	0	0	1	0	1
		STSL	1	1	0	1	0	0	0	0	0	1	0

Table B.47 Summary of faulting data for SPS-2 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	PDPJ	2	2	1	1	0	0	0	0	1	1	0
		PDPJ-PDPOJ	3	3	2	0	1	0	0	0	2	0	1
	CA (6)	GS	1	1	1	0	0	0	0	0	0	0	0
		LSLJS	6	6	2	2	2	0	0	0	2	2	2
		LSLJS-TJS	7	10	2	1	7	0	0	0	2	1	7
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
Dry-freeze	CO (8)	PDPJ	5	8	3	2	3	0	1	0	4	2	2
		PDPOJ	1	1	1	0	0	0	0	0	1	0	0
	NV (32)	CS	6	10	0	0	6	0	0	0	0	0	6
		FDPOJ	1	4	0	1	1	0	0	0	0	1	1
		PDPJ	2	2	0	0	1	0	1	0	1	0	0
		PDPOJ	3	6	0	2	1	0	0	0	0	2	1
		CS-PDPJ	2	2	0	0	1	0	0	0	0	0	1
		CS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
Wet-no-freeze	AR (5)	CS	1	1	0	1	0	0	0	0	0	1	0
		CS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS	1	1	0	1	0	0	0	0	0	1	0
		LSLJS	12	12	0	0	11	0	0	0	0	0	11
		PDPJ	3	4	0	0	2	0	0	0	0	0	2
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	2	0	0	0	0	0	2	0	0
	NC (37)	PDPJ	1	1	0	0	1	0	0	0	0	0	1

Table B.47 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	DE (10)	CS-OTHER	1	1	0	0	0	0	0	0	0	0	0
		CS-PPH	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	2	0	0	0	0	0	2
		GS	7	7	6	0	0	0	0	0	6	0	0
		LSLJS	3	3	0	3	0	0	0	0	0	3	0
		PPH	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	IA (19)	TJS-LSLJS-SR	1	1	0	0	1	0	0	0	0	0	1
		SR	1	1	0	1	0	0	0	0	0	1	0
	KS (20)	FDTJRP	5	5	0	5	0	0	0	0	0	5	0
		FDTJRP-FDPOJ	3	3	0	0	0	0	0	0	0	0	0
		PDPJ	4	6	0	1	1	0	0	0	0	1	1
		PDPJ-SR	1	1	0	0	1	0	0	0	0	0	1
		SR	1	2	0	1	0	0	0	0	0	1	0
		TJS	3	3	2	0	1	0	0	0	2	0	1
		TJS-LSLJS	9	9	6	3	0	0	0	0	6	3	0
	OH (39)	OTHER	3	3	0	3	0	0	0	0	0	3	0
	MI (26)	ACSR	1	2	0	1	0	0	0	0	0	1	0
		LSLJS	7	7	6	1	0	0	0	0	6	1	0
		PDPJ	5	6	4	1	1	0	0	0	4	1	1
		SR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0

Table B.48 Summary of faulting data for SPS-4 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	AZ (4)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	CA (6)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
		FDPOJ	1	3	0	0	1	0	0	0	0	0	1
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPJ	1	1	0	0	1	0	0	0	0	0	1
		PDPJ	3	8	0	1	0	0	0	0	0	1	0

Table B.48 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	CA (6)	ACSR	2	2	0	0	1	0	0	0	0	0	1
		CS-TJS	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	CO (8)	PDPJ	2	2	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	KS (20)	FDTJRP	1	1	0	1	0	0	1	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		TJS-PDPJ	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	PDPJ	2	5	0	0	0	0	0	0	0	0	0
	NV (32)	CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG-CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
	SD (46)	ACSR	2	2	0	0	1	0	0	0	0	0	1
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
	UT (49)	LSLJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	4	5	0	2	3	0	0	0	0	2	3

Table B.48 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IN (18)	PDPJ	2	2	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	IA (19)	TJS	2	2	0	0	0	0	0	0	0	0	0
	MO (29)	CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	3	3	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
	OH (39)	CS-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
		TJS-LSLJS	2	2	0	0	0	0	0	0	0	0	0
	PA (42)	ACSR	2	2	0	1	0	0	0	0	0	1	0
		FDPOJ	1	1	0	1	0	0	0	0	0	1	0
		FDPOJ-PDPJ-SR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	1	0	0	0	0	0	1
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		SR	2	2	0	0	1	0	0	0	0	0	1
		TJS-LSLJS	2	2	0	0	1	0	0	0	0	0	1
Wet-no-freeze	AR (5)	TJS-LSLJS	3	3	0	0	2	0	0	0	0	0	2
	OK (40)	TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
		PG-CS-TJS-LSLJS	1	1	0	0	1	0	0	0	0	0	1
	TX (48)	TJS-LSLJS	4	4	0	0	4	0	0	0	0	0	4
		CS-TJS-LSLJS	2	2	0	0	2	0	0	0	0	0	2
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	1	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	1	0	0	0	0	0	1	0
		PDPJ-TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0
		PG-TJS-LSLJS	1	1	0	1	0	0	0	0	0	1	0

Table B.49 Summary of faulting data for SPS-6 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-freeze	AZ (4)	PDPJ	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS-PDPOJ-ACSR	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS-FDTJRP-PDPOJ-PCCSR-GS-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
	CA (6)	ACSR	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		CS-GS-TJS-LSLJS-FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	1	3	0	0	0	0	0	0	0	0	0
		GS-LS-TJS-FDTJRP-SR	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	2	2	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
	SD (46)	ACSR	2	2	0	0	0	0	0	0	0	0	0
		ACSR-ACOL	3	3	0	1	0	0	0	0	0	1	0
		ACSR-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		ACSR-PDPJ-PDPOJ	2	2	0	0	0	0	0	0	0	0	0
		ASC	3	3	0	0	0	0	0	0	0	0	0
		CS-GS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		CS-LSLJS	3	3	0	0	0	0	0	0	0	0	0
		FDTJRP	2	2	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	7	0	0	1	0	0	0	0	0	1
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PGS-LS-JLTR-CS-GS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0

Table B.49 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	AL (1)	ACSR	3	3	0	0	3	0	0	0	0	0	3
		GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		JLTR-TJS-GS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
	AK (5)	ACSR	3	3	0	0	0	0	0	0	0	0	0
		CS-GS-TJS	2	2	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	3	3	0	0	0	0	0	0	0	0	0
		FDPOJ-PDPOJ	2	2	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PDPOJ	3	3	0	0	2	0	0	0	0	0	2
		JLTR-FDPOJ-LS-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		MPSP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	3	4	0	2	0	0	0	0	0	2	0
		PDPOJ	3	4	0	0	0	0	0	0	0	0	0
	OK (40)	FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-LS-TJS	1	1	0	0	0	0	0	0	0	0	0
		GS-ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	3	0	0	1	0	0	0	0	0	1
		PDPJ-GS-TJS-ACSR	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	12	0	3	3	0	0	0	0	3	3
		TJS-FDTJRP	1	1	0	0	1	0	0	0	0	0	1

Table B.49 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-no-freeze	TN (47)	FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-ACSR	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		GS-TJS-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		LS	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PCCSR-ACSR	1	1	0	0	1	0	0	0	0	0	1
		PDPOJ	2	4	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-PCCSR	3	4	0	1	0	0	0	0	0	1	0
Wet-freeze	IL (17)	ACOL-ACSR	3	3	0	0	3	0	0	0	0	0	3
		ACSR	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-ACSR	1	1	0	0	1	0	0	0	0	0	1
		CS-TJS-GS	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	3	5	0	0	0	0	0	0	0	0	0
		FDTJRP-PGS-LS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	2	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	2	0	1	0	0	0	0	0	1	0
		PDPOJ	1	1	0	1	0	0	0	0	0	1	0
		SP	3	7	0	1	0	0	0	0	0	1	0
	IN (18)	ACSR	1	1	0	0	1	0	0	0	0	0	1
		FDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-JLTR	1	1	0	0	1	0	0	0	0	0	1
		FDTJRP-LS-JLTR	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	0	1	0	0	0	0	0	1	0
		GS-FDPOJ-PDPJ	1	1	0	1	0	0	0	0	0	1	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	0	2	2	0	0	0	0	2	2

Table B.49 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	IA (19)	ACSR-CS-SP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-SP	1	1	0	0	0	0	0	0	0	0	0
		ACSR-CS	1	1	0	0	0	0	0	0	0	0	0
		CS	3	8	0	0	0	0	0	0	0	0	0
		FDTJRP-FDPOJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		LS-ACSR-ACOL	1	1	0	0	0	0	0	0	0	0	0
		LS-JLTR-PDPJ-GS-TJS-FDTJRP-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	3	5	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-GS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ-CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		TJS	1	1	0	0	0	0	0	0	0	0	0
	MI (26)	PDPJ-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PDPJ-LS-GS-TJS-FDTJRP	1	1	0	0	1	0	0	0	0	0	1
		GS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	2	2	0	0	0	0	0	0	0	0	0
	MO (29)	CS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		FDPOJ	3	7	0	0	0	0	0	0	0	0	0
		GS	1	1	0	0	0	0	0	0	0	0	0
		GS-FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		PG-CS-FDTJRP-PCC	1	1	0	0	0	0	0	0	0	0	0
		SAS	1	1	0	0	0	0	0	0	0	0	0
		SP	3	3	0	0	0	0	0	0	0	0	0
		SR	2	2	0	0	0	0	0	0	0	0	0
		TJS-FDPOJ-LSLJS	3	11	0	0	0	0	0	0	0	0	0

Table B.49 (cont'd)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Wet-freeze	MO (29)	CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		CS-GS-TJS-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		LSLJ-CS-GS-TJS-PG-FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	3	3	0	0	2	0	0	0	0	0	2
		CS	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	ACSR-TJS	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		JLTR-GS-FDTJRP-PCCSR-PDPOJ-PGS-LS	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	3	18	0	1	1	0	0	0	0	1	1
		PDPJ-PDPOJ	1	2	0	0	0	0	0	0	0	0	0
		PDPOJ	2	4	0	0	0	0	0	0	0	0	0

Table B.50 Summary of faulting data for GPS-9 test sections

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone	State (code)	Treatment data		Number of treatment applications									
		Type	Number of sections	Total	With 3 or more data points			With one assigned data point after treatment (0.01 year)			To be analyzed		
					BT & AT	BT only	AT only	BT & AT	BT only	AT only	BT & AT	BT only	AT only
Dry-no-freeze	CA (6)	PCCSR	2	2	0	1	0	0	0	0	0	1	0
		FDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS	1	1	0	0	0	0	0	0	0	0	0
		LSLJS	1	1	0	0	0	0	0	0	0	0	0
		GS-PDPJ-PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	TX (48)	ACOL	1	1	0	1	0	0	0	0	0	1	0
Wet-freeze	KS (20)	FDPOJ	1	1	0	1	0	0	0	0	0	1	0
	MI (26)	PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
		PCCSR	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
	MN (27)	PDPJ	1	2	0	0	0	0	0	0	0	0	0
		FDTJRP	1	1	0	0	0	0	0	0	0	0	0
	NE (31)	CS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		PDPJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS	1	1	0	0	0	0	0	0	0	0	0
		PDPOJ	1	2	0	0	0	0	0	0	0	0	0
	OH (39)	PPH-PDPJ-PDPOJ	1	1	0	0	0	0	0	0	0	0	0
		CS-TJS-LSLJS	1	1	0	0	0	0	0	0	0	0	0
		JTLR	1	1	0	0	0	0	0	0	0	0	0
		FDTJRP-GS	1	1	0	0	1	0	0	0	0	0	1
		PCCSR-OTHER	1	1	0	0	1	0	0	0	0	0	1
	PA (42)	GS	2	2	2	0	0	0	0	0	2	0	0
		ACSR-ACOL-LS	1	1	0	1	0	0	0	0	0	1	0
		TJS	1	1	0	0	1	0	0	0	0	0	1

APPENDIX C

Detailed Results of the Analyses of LTPP SPS-1 Test sections Impacts of Climatic Regions, AC Thickness, and Drainage on Pavement Performance

APPENDIX C

Detailed Results of the Analyses of LTPP SPS-1 Test sections

Impacts of Climatic Regions, AC Thickness, and Drainage on Pavement Performance

The pavement condition and distress data of LTPP SPS-1 test sections were analyzed to determine the impacts of the pavement design factors and environmental conditions on pavement performance. The design factors included in the analyses are the thickness of the asphalt concrete (AC) and the presence or absence of base layer drainage. The test sections are located in the four environmental regions; wet-freeze (WF), wet-no-freeze (WNF), dry-freeze (DF), and dry-no-freeze (DNF).

The data in the last two columns of Tables C.1 through C.20 express the comparative differences in pavement performance (in terms of the remaining functional period (RFP) and the remaining structural period (RSP)) between test sections located in the indicated climatic zones. For example, the last two columns in Table C.1 provide the comparative difference between the average RFP values in the wet-freeze and in the wet-no-freeze zones. A negative number implies worse performance whereas a positive means better performance. To illustrate, the two test sections having SHRP ID 0101 (first row in Table C.1), AC thickness of 4-inch and drainable bases, the average RFP (based on IRI) of the one section located in the wet-freeze region is 12 years less than the average RFP of the one test section located in the wet-no-freeze zone.

The corresponding RFPs for each group of test sections are plotted in Figures C.1 through C.20. Open symbols in the figures represent the average RFP of test sections having the same SHRP ID. Closed symbols represent the overall average of the RFP of all test sections located in the same climatic region and having the same AC thickness. The numbers in the figures near the data points indicate the number of test sections included in the analyses. The numbers in parenthesis are the number of SHRP IDs included in the analyses. For example 14(6) implies 14 test sections having six different SHRP ID.

Table C.1 Impacts of WF and WNF climatic regions on pavement performance in terms of the remaining functional period (RFP) based on IRI of LTPP SPS-1 test sections

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RFP (year)	
			Number of sections	RFP (year)			Number of sections	RFP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	WNF
107	4	Y	1	8	8	8	1	20	20	20	-12	12
111	4	Y	3	20	20	20	2	20	20	20	0	0
112	4	Y	3	20	20	20	2	20	20	20	0	0
120	4	Y	2	20	20	20	3	20	20	20	0	0
122	4	Y	2	20	20	20	3	20	20	20	0	0
121	4	Y	3	20	20	20	4	17	20	19	1	-1
105	4	N	2	4	8	6	2	20	20	20	-14	14
102	4	N	1	8	8	8	2	20	20	20	-12	12
103	4	N	2	6	12	9	2	20	20	20	-11	11
118	4	N	3	16	20	19	2	20	20	20	-1	1
113	4	N	2	15	20	17	4	12	20	18	-1	1
116	4	N	3	20	20	20	3	20	20	20	0	0
108	7	Y	3	8	16	12	1	20	20	20	-8	8
110	7	Y	3	13	20	16	1	20	20	20	-4	4
109	7	Y	3	10	20	16	2	20	20	20	-4	4
119	7	Y	2	20	20	20	2	20	20	20	0	0
123	7	Y	3	20	20	20	4	20	20	20	0	0
124	7	Y	2	20	20	20	3	20	20	20	0	0
101	7	N	1	7	7	7	2	20	20	20	-13	13
117	7	N	2	12	20	16	4	20	20	20	-4	4
106	7	N	2	15	19	17	2	20	20	20	-3	3
114	7	N	2	18	20	19	3	20	20	20	-1	1
115	7	N	2	18	20	19	3	20	20	20	-1	1
104	7	N	2	20	20	20	2	20	20	20	0	0
58% of test sections in WNF performed better; 4% performed worse and 38% performed the same relative to those in the WF region; NC = Could not be compared												

Table C.2 Impacts of DF and DNF climatic zones on pavement performance in terms of remaining functional period (RFP) based on IRI of LTPP SPS-1 test sections

SHRP ID	AC thickness (inch)	Drainage	Dry freeze (DF)				Dry-no-freeze (DNF)				Difference in RFP (year)	
			Number of sections	RFP (year)			Number of sections	RFP (year)				
				Min	Max	Avg		Min	Max	Avg	DF	DNF
122	4	Y	1	17	17	17	1	20	20	20	-3	3
121	4	Y	1	17	17	17	1	20	20	20	-3	3
120	4	Y	1	17	17	17	1	20	20	20	-3	3
107	4	Y	1	20	20	20	1	20	20	20	0	0
111	4	Y	1	20	20	20	1	20	20	20	0	0
112	4	Y	0	0	0	-	1	20	20	20	NC	NC
113	4	N	1	20	20	20	1	20	20	20	0	0
116	4	N	1	20	20	20	1	20	20	20	0	0
118	4	N	1	20	20	20	1	20	20	20	0	0
103	4	N	1	20	20	20	1	17	17	17	3	-3
102	4	N	1	20	20	20	1	16	16	16	4	-4
105	4	N	0	0	0	-	1	20	20	20	NC	NC
108	7	Y	1	20	20	20	1	20	20	20	0	0
110	7	Y	1	20	20	20	1	20	20	20	0	0
119	7	Y	1	20	20	20	1	20	20	20	0	0
123	7	Y	1	20	20	20	1	20	20	20	0	0
124	7	Y	1	20	20	20	1	20	20	20	0	0
109	7	Y	0	0	0	-	1	20	20	20	NC	NC
114	7	N	1	20	20	20	1	20	20	20	0	0
115	7	N	1	20	20	20	1	20	20	20	0	0
117	7	N	1	20	20	20	1	20	20	20	0	0
101	7	N	0	0	0	-	1	20	20	20	NC	NC
104	7	N	0	0	0	-	1	20	20	20	NC	NC
106	7	N	0	0	0	-	1	20	20	20	NC	NC
17% of test sections in DNF performed better; 11% performed worse and 72% performed the same relative to those in the DF region; NC = Could not be compared												

Table C.3 Impacts of WF and DF climatic zones on pavement performance in terms of remaining functional period (RFP) based on IRI of LTPP SPS-1 test sections

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Dry-freeze (WNF)				Difference in RFP (year)	
			Number of sections	RFP (year)			Number of sections	RFP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	DF
107	4	Y	1	8	8	8	1	20	20	20	-12	12
111	4	Y	3	20	20	20	1	20	20	20	0	0
120	4	Y	2	20	20	20	1	17	17	17	3	-3
121	4	Y	3	20	20	20	1	17	17	17	3	-3
122	4	Y	2	20	20	20	1	17	17	17	3	-3
112	4	Y	3	20	20	20	0	0	0	-	NC	NC
102	4	N	1	8	8	8	1	20	20	20	-12	12
103	4	N	2	6	12	9	1	20	20	20	-11	11
113	4	N	2	15	20	17	1	20	20	20	-3	3
118	4	N	3	16	20	19	1	20	20	20	-1	1
116	4	N	3	20	20	20	1	20	20	20	0	0
105	4	N	2	4	8	6	0	0	0	-	NC	NC
108	7	Y	3	8	16	12	1	20	20	20	-8	8
110	7	Y	3	13	20	16	1	20	20	20	-4	4
119	7	Y	2	20	20	20	1	20	20	20	0	0
123	7	Y	3	20	20	20	1	20	20	20	0	0
124	7	Y	2	20	20	20	1	20	20	20	0	0
109	7	Y	3	10	20	16	0	0	0	-	NC	NC
117	7	N	2	12	20	16	1	20	20	20	-4	4
114	7	N	2	18	20	19	1	20	20	20	-1	1
115	7	N	2	18	20	19	1	20	20	20	-1	1
101	7	N	1	7	7	7	0	0	0	-	NC	NC
104	7	N	2	20	20	20	0	0	0	-	NC	NC
106	7	N	2	15	19	17	0	0	0	-	NC	NC
56% of test sections in DF performed better; 28% performed worse and 16% performed the same relative to those in the WF region; NC = Could not be compared												

Table C.4 Impacts of WNF and DNF climatic zones on pavement performance in terms of remaining functional period (RFP) based on IRI of LTPP SPS-1 test sections

SHRP ID	AC thickness (inch)	Drainage	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RFP (year)	
			Number of sections	RFP (year) Min	Max	Avg	Number of sections	RFP (year) Min	Max	Avg	WNF	DNF
0121	4	Y	4	17	20	19	1	20	20	20	-1	1
0107	4	Y	1	20	20	20	1	20	20	20	0	0
0111	4	Y	2	20	20	20	1	20	20	20	0	0
0112	4	Y	2	20	20	20	1	20	20	20	0	0
0120	4	Y	3	20	20	20	1	20	20	20	0	0
0122	4	Y	3	20	20	20	1	20	20	20	0	0
0113	4	N	4	12	20	18	1	20	20	20	-2	2
0105	4	N	2	20	20	20	1	20	20	20	0	0
0116	4	N	3	20	20	20	1	20	20	20	0	0
0118	4	N	2	20	20	20	1	20	20	20	0	0
0103	4	N	2	20	20	20	1	17	17	17	3	-3
0102	4	N	2	20	20	20	1	16	16	16	4	-4
0108	7	Y	1	20	20	20	1	20	20	20	0	0
0109	7	Y	2	20	20	20	1	20	20	20	0	0
0110	7	Y	1	20	20	20	1	20	20	20	0	0
0119	7	Y	2	20	20	20	1	20	20	20	0	0
0123	7	Y	4	20	20	20	1	20	20	20	0	0
0124	7	Y	3	20	20	20	1	20	20	20	0	0
0101	7	N	2	20	20	20	1	20	20	20	0	0
0104	7	N	2	20	20	20	1	20	20	20	0	0
0106	7	N	2	20	20	20	1	20	20	20	0	0
0114	7	N	3	20	20	20	1	20	20	20	0	0
0115	7	N	3	20	20	20	1	20	20	20	0	0
0117	7	N	4	20	20	20	1	20	20	20	0	0

8% of test sections in DNF performed better; 8% performed worse and 84% performed the same relative to those in the WNF region;
NC = no change

Table C.5 Impacts of WF and WNF climatic zones on pavement performance of the LTPP SPS-1 test sections in terms of remaining functional/structural period (RFP/RSP) based on rut depth

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RFP/RSP (year)	
			Number of sections	RFP/RSP (year)			Number of sections	RFP/RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	WNF
107	4	Y	2	0	4	3	2	20	20	20	-17	17
122	4	Y	2	17	17	11	4	20	20	20	-9	9
121	4	Y	3	8	20	15	4	8	20	17	-2	2
120	4	Y	3	9	20	15	3	9	20	16	-1	1
111	4	Y	3	20	20	20	2	20	20	20	0	0
112	4	Y	3	20	20	20	2	20	20	20	0	0
102	4	N	2	0	3	3	2	16	20	18	-15	15
105	4	N	2	6	6	6	2	20	20	20	-14	14
116	4	N	3	8	17	10	3	20	20	20	-10	10
118	4	N	3	9	20	11	3	20	20	20	-9	9
103	4	N	2	9	17	13	2	20	20	20	-7	7
113	4	N	2	8	20	11	4	8	20	17	-6	6
108	7	Y	3	9	19	11	2	20	20	20	-9	9
119	7	Y	2	20	20	12	2	20	20	20	-8	8
123	7	Y	3	13	17	11	4	10	20	17	-6	6
109	7	Y	3	10	20	14	2	20	20	20	-6	6
124	7	Y	3	4	16	11	3	4	20	15	-3	3
110	7	Y	3	20	20	20	1	20	20	20	0	0
101	7	N	1	4	4	4	2	20	20	20	-16	16
115	7	N	3	9	9	7	3	20	20	20	-13	13
117	7	N	3	11	12	9	4	20	20	20	-11	11
114	7	N	2	7	16	10	4	7	20	17	-7	7
106	7	N	2	7	20	14	2	20	20	20	-6	6
104	7	N	2	20	20	20	2	20	20	20	0	0
83% of test sections in WNF performed better; 17% performed the same relative to those in the WF region; NC = Could not be compared												

Table C.6 Impacts of DF and DNF climatic zones on pavement performance of the LTPP SPS-1 test sections in terms of remaining functional/structural period (RFP/RSP) based on rut depth

SHRP ID	AC thickness (inch)	Drainage	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RFP/RSP (year)	
			Number of sections	RFP/RSP (year)			Number of sections	RFP/RSP (year)				
				Min	Max	Avg		Min	Max	Avg	DF	DNF
111	4	Y	1	20	20	20	1	20	20	20	0	0
112	4	Y	0	0	20	20	1	20	20	20	0	0
107	4	Y	0	0	0	-	1	20	20	20	NC	NC
120	4	Y	1	0	18	18	0	0	0	-	NC	NC
121	4	Y	1	0	12	12	0	0	0	-	NC	NC
122	4	Y	1	20	20	20	0	0	0	-	NC	NC
102	4	N	1	20	20	20	1	20	20	20	0	0
103	4	N	1	20	20	20	1	20	20	20	0	0
105	4	N	1	20	20	20	1	20	20	20	0	0
113	4	N	1	0	20	20	0	0	0	-	NC	NC
116	4	N	1	20	20	20	0	0	0	-	NC	NC
118	4	N	1	20	20	20	0	0	0	-	NC	NC
108	7	Y	1	20	20	20	1	20	20	20	0	0
109	7	Y	1	20	20	20	1	20	20	20	0	0
110	7	Y	0	0	0	-	1	20	20	20	NC	NC
119	7	Y	1	20	20	20	0	0	0	-	NC	NC
123	7	Y	1	20	20	20	0	0	0	-	NC	NC
124	7	Y	1	20	20	20	0	0	0	-	NC	NC
101	7	N	1	20	20	20	1	20	0	20	0	0
106	7	N	1	20	20	20	1	20	20	20	0	0
104	7	N	1	20	20	20	0	0	0	-	NC	NC
114	7	N	1	20	20	20	0	0	0	-	NC	NC
115	7	N	1	20	20	20	0	0	0	-	NC	NC
117	7	N	1	20	20	20	0	0	0	-	NC	NC
100% of test sections in the DNF region performed the same relative to those in the DF region; NC = Could not be compared												

Table C.7 Impacts of WF and DF climatic zones on pavement performance of the LTPP SPS-1 test sections in terms of remaining functional/structural period (RFP/RSP) based on rut depth

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RFP/RSP (year)	
			Number of sections	RFP/RSP (year)			Number of sections	RFP/RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	DF
122	4	Y	2	17	17	11	1	20	20	20	-9	9
120	4	Y	3	9	20	15	1	0	18	18	-3	3
111	4	Y	3	20	20	20	1	20	20	20	0	0
112	4	Y	3	20	20	20	0	0	20	20	0	0
121	4	Y	3	8	20	15	1	0	12	12	3	-3
107	4	Y	2	0	4	3	0	0	0	-	NC	NC
102	4	N	2	0	3	3	1	20	20	20	-17	17
105	4	N	2	6	6	6	1	20	20	20	-14	14
116	4	N	3	8	17	10	1	20	20	20	-10	10
118	4	N	3	9	20	11	1	20	20	20	-9	9
113	4	N	2	8	20	11	1	0	20	20	-9	9
103	4	N	2	9	17	13	1	20	20	20	-7	7
108	7	Y	3	9	19	11	1	20	20	20	-9	9
123	7	Y	3	13	17	11	1	20	20	20	-9	9
124	7	Y	3	4	16	11	1	20	20	20	-9	9
119	7	Y	2	20	20	12	1	20	20	20	-8	8
109	7	Y	3	10	20	14	1	20	20	20	-6	6
110	7	Y	3	20	20	20	0	0	0	-	NC	NC
101	7	N	1	4	4	4	1	20	20	20	-16	16
115	7	N	3	9	9	7	1	20	20	20	-13	13
117	7	N	3	11	12	9	1	20	20	20	-11	11
114	7	N	2	7	16	10	1	20	20	20	-10	10
106	7	N	2	7	20	14	1	20	20	20	-6	6
104	7	N	2	20	20	20	1	20	20	20	0	0
82% of test sections in DF performed better; 14% performed worse and 4% performed the same relative to those in the WF region; NC = Could not be compared												

Table C.8 Impacts of WNF and DNF climatic zones on pavement performance of the LTPP SPS-1 test sections in terms of remaining functional/structural period (RFP/RSP) based on rut depth

SHRP ID	AC thickness (inch)	Drainage	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RFP/RSP (year)	
			Number of sections	RFP/RSP (year)			Number of sections	RFP/RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WNF	DNF
107	4	Y	2	20	20	20	1	20	20	20	0	0
111	4	Y	2	20	20	20	1	20	20	20	0	0
112	4	Y	2	20	20	20	1	20	20	20	0	0
120	4	Y	3	9	20	16	0	0	0	-	NC	NC
121	4	Y	4	8	20	17	0	0	0	-	NC	NC
122	4	Y	4	20	20	20	0	0	0	-	NC	NC
102	4	N	2	16	20	18	1	20	20	20	-2	2
103	4	N	2	20	20	20	1	20	20	20	0	0
105	4	N	2	20	20	20	1	20	20	20	0	0
113	4	N	4	8	20	17	0	0	0	-	NC	NC
116	4	N	3	20	20	20	0	0	0	-	NC	NC
118	4	N	3	20	20	20	0	0	0	-	NC	NC
108	7	Y	2	20	20	20	1	20	20	20	0	0
109	7	Y	2	20	20	20	1	20	20	20	0	0
110	7	Y	1	20	20	20	1	20	20	20	0	0
119	7	Y	2	20	20	20	0	0	0	-	NC	NC
123	7	Y	4	10	20	17	0	0	0	-	NC	NC
124	7	Y	3	4	20	15	0	0	0	-	NC	NC
101	7	N	2	20	20	20	1	20	0	20	0	0
106	7	N	2	20	20	20	1	20	20	20	0	0
104	7	N	2	20	20	20	0	0	0	-	NC	NC
114	7	N	4	7	20	17	0	0	0	-	NC	NC
115	7	N	3	20	20	20	0	0	0	-	NC	NC
117	7	N	4	20	20	20	0	0	0	-	NC	NC
9% of test sections in DNF performed better; 91% performed the same relative to those in the WNF region; NC = Could not be compared												

Table C.9 Impacts of WF and WNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on alligator cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	WNF
0112	4	Y	3	9	12	11	2	16	20	18	-7	7
0111	4	Y	3	9	17	12	2	14	20	17	-5	5
0121	4	Y	1	18	18	18	4	11	20	16	2	-2
0122	4	Y	1	20	20	20	4	13	20	18	2	-2
0120	4	Y	1	20	20	20	3	11	20	17	3	-3
0107	4	Y	1	20	20	20	2	12	20	16	4	-4
0103	4	N	2	7	8	7	2	16	20	18	-11	11
0105	4	N	2	5	9	7	2	12	20	16	-9	9
0116	4	N	2	8	20	14	3	17	20	19	-5	5
0102	4	N	2	6	20	13	2	10	20	15	-2	2
0113	4	N	1	17	17	17	4	8	20	14	3	-3
0118	4	N	1	20	20	20	3	12	20	17	3	-3
0109	7	Y	2	7	8	8	2	13	20	16	-9	9
0110	7	Y	3	7	13	9	2	15	20	18	-9	9
0124	7	Y	2	8	20	14	2	20	20	20	-6	6
0108	7	Y	2	7	20	13	2	14	20	17	-4	4
0119	7	Y	1	20	20	20	2	20	20	20	0	0
0123	7	Y	2	20	20	20	4	20	20	20	0	0
0104	7	N	3	8	16	12	2	18	20	19	-8	8
0106	7	N	3	7	20	13	2	18	20	19	-6	6
0115	7	N	2	8	20	14	3	19	20	20	-6	6
0101	7	N	2	12	20	16	1	20	20	20	-4	4
0114	7	N	2	6	20	13	3	12	20	15	-3	3
0117	7	N	2	8	20	14	3	13	20	16	-2	2
67% of the test sections in WNF performed better, 25% performed worse while 8% perform same relative to those in WF region;												

Table C.10 Impacts of DF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on alligator cracking

SHRP ID	AC thickness (inch)	Drainage	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	DF	DNF
0120	4	Y	1	6	6	6	1	8	8	8	-2	2
0122	4	Y	1	7	7	7	1	8	8	8	-2	2
0111	4	Y	1	20	20	20	1	20	20	20	0	0
0121	4	Y	1	7	7	7	1	7	7	7	0	0
0112	4	Y	1	20	20	20	1	15	15	15	5	-5
0107	4	Y	1	20	20	20	1	13	13	13	7	-7
0116	4	N	1	7	7	7	1	10	10	10	-2	2
0118	4	N	1	7	7	7	1	9	9	9	-2	2
0113	4	N	1	7	7	7	1	9	9	9	-1	1
0102	4	N	1	12	12	12	1	10	10	10	1	-1
0103	4	N	1	16	16	16	1	14	14	14	1	-1
0105	4	N	1	20	20	20	1	12	12	12	8	-8
0119	7	Y	1	9	9	9	1	18	18	18	-9	9
0123	7	Y	1	9	9	9	1	15	15	15	-5	5
0124	7	Y	1	9	9	9	1	14	14	14	-4	4
0110	7	Y	1	20	20	20	1	20	20	20	0	0
0108	7	Y	1	20	20	20	1	14	14	14	6	-6
0109	7	Y	1	20	20	20	1	13	13	13	7	-7
0115	7	N	1	8	8	8	1	18	18	18	-10	10
0117	7	N	1	8	8	8	1	16	16	16	-8	8
0114	7	N	1	8	8	8	1	8	8	8	-1	1
0106	7	N	1	20	20	20	1	20	20	20	0	0
0104	7	N	1	20	20	20	1	15	15	15	5	-5
0101	7	N	1	20	20	20	1	14	14	14	6	-6
46% of the test sections in DNF performed better , 38% performed worse and 16% performed same relative to those in the DF region; NC =could not be compared												

Table C.11 Impacts of WF and DF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on alligator cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	DF
0112	4	Y	3	9	12	11	1	20	20	20	-9	9
0111	4	Y	3	9	17	12	1	20	20	20	-8	8
0107	4	Y	1	20	20	20	1	20	20	20	0	0
0121	4	Y	1	18	18	18	1	7	7	7	11	-11
0122	4	Y	1	20	20	20	1	7	7	7	13	-13
0120	4	Y	1	20	20	20	1	6	6	6	14	-14
0105	4	N	2	5	9	7	1	20	20	20	-13	13
0103	4	N	2	7	8	7	1	16	16	16	-8	8
0102	4	N	2	6	20	13	1	12	12	12	2	-2
0116	4	N	2	8	20	14	1	7	7	7	7	-7
0113	4	N	1	17	17	17	1	7	7	7	9	-9
0118	4	N	1	20	20	20	1	7	7	7	13	-13
0109	7	Y	2	7	8	8	1	20	20	20	-12	12
0110	7	Y	3	7	13	9	1	20	20	20	-11	11
0108	7	Y	2	7	20	13	1	20	20	20	-7	7
0124	7	Y	2	8	20	14	1	9	9	9	5	-5
0119	7	Y	1	20	20	20	1	9	9	9	11	-11
0123	7	Y	2	20	20	20	1	9	9	9	11	-11
0104	7	N	3	8	16	12	1	20	20	20	-8	8
0106	7	N	3	7	20	13	1	20	20	20	-7	7
0101	7	N	2	12	20	16	1	20	20	20	-4	4
0114	7	N	2	6	20	13	1	8	8	8	5	-5
0115	7	N	2	8	20	14	1	8	8	8	6	-6
0117	7	N	2	8	20	14	1	8	8	8	6	-6
42% of the test sections in DF performed better , 54% of the sections performed worse and 4% performed the same relative to those in the WF region; NC =could not be compared												

Table C.12 Impacts of WNF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on alligator cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WNF	DNF
0111	4	Y	2	14	20	17	1	20	20	20	-3	3
0107	4	Y	2	12	20	16	1	13	13	13	3	-3
0112	4	Y	2	16	20	18	1	15	15	15	3	-3
0120	4	Y	3	11	20	17	1	8	8	8	9	-9
0121	4	Y	4	11	20	16	1	7	7	7	9	-9
0122	4	Y	4	13	20	18	1	8	8	8	10	-10
0103	4	N	2	16	20	18	1	14	14	14	4	-4
0105	4	N	2	12	20	16	1	12	12	12	4	-4
0102	4	N	2	10	20	15	1	10	10	10	5	-5
0113	4	N	4	8	20	14	1	9	9	9	5	-5
0116	4	N	3	17	20	19	1	10	10	10	9	-9
0118	4	N	3	12	20	17	1	9	9	9	9	-9
0110	7	Y	2	15	20	18	1	20	20	20	-2	2
0119	7	Y	2	20	20	20	1	18	18	18	2	-2
0108	7	Y	2	14	20	17	1	14	14	14	3	-3
0109	7	Y	2	13	20	16	1	13	13	13	3	-3
0123	7	Y	4	20	20	20	1	15	15	15	5	-5
0124	7	Y	2	20	20	20	1	14	14	14	6	-6
0106	7	N	2	18	20	19	1	20	20	20	-1	1
0117	7	N	3	13	20	16	1	16	16	16	1	-1
0115	7	N	3	19	20	20	1	18	18	18	2	-2
0104	7	N	2	18	20	19	1	15	15	15	4	-4
0101	7	N	1	20	20	20	1	14	14	14	6	-6
0114	7	N	3	12	20	15	1	8	8	8	7	-7
13% of the test sections in DNF performed better , 87% of the sections performed worse relative to those in the WNF region;												

Table C.13 Impacts of WF and WNF climatic zones on pavement performance of LTPP SPS-1test sections in terms of remaining structural period (RSP) based on longitudinal cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	WNF
0111	4	Y	3	9	20	13	2	20	20	20	-7	7
0121	4	Y	1	9	9	9	4	8	20	17	-7	7
0122	4	Y	1	8	8	8	4	8	20	16	-7	7
0120	4	Y	1	8	8	8	3	8	20	14	-6	6
0112	4	Y	2	12	20	16	2	20	20	20	-4	4
0107	4	Y	1	20	20	20	2	19	20	20	0	0
0116	4	N	2	8	8	8	3	18	20	19	-11	11
0118	4	N	1	9	9	9	3	20	20	20	-11	11
0103	4	N	2	8	14	11	2	20	20	20	-9	9
0113	4	N	1	9	9	9	4	8	20	17	-8	8
0105	4	N	2	11	20	16	2	19	20	19	-4	4
0102	4	N	2	17	20	19	2	17	19	18	1	-1
0119	7	Y	1	10	10	10	2	20	20	20	-10	10
0123	7	Y	2	10	10	10	4	12	20	18	-8	8
0109	7	Y	3	8	20	12	2	20	20	20	-7	7
0124	7	Y	2	8	9	9	3	8	20	16	-7	7
0108	7	Y	3	7	20	14	2	19	20	19	-5	5
0110	7	Y	3	11	20	14	2	19	20	20	-5	5
0104	7	N	2	10	10	10	2	20	20	20	-10	10
0115	7	N	2	9	9	9	3	11	20	17	-8	8
0117	7	N	2	9	12	11	4	8	20	16	-5	5
0101	7	N	2	12	20	16	2	18	20	19	-3	3
0106	7	N	3	12	20	17	2	17	20	18	-2	2
0114	7	N	2	7	20	14	4	8	20	14	0	0
88% of the test sections in WNF performed better, 4% performed worse while 8% perform same relative to those in WF region;												

Table C.14 Impacts of DF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on longitudinal cracking

SHRP ID	AC thickness (inch)	Drainage	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	DF	DNF
0121	4	Y	1	6	6	6	1	20	20	20	-14	14
0122	4	Y	1	6	6	6	1	20	20	20	-14	14
0120	4	Y	1	6	6	6	1	10	10	10	-4	4
0107	4	Y	1	20	20	20	1	20	20	20	0	0
0111	4	Y	1	20	20	20	1	20	20	20	0	0
0112	4	Y	1	20	20	20	1	20	20	20	0	0
0118	4	N	1	6	6	6	1	20	20	20	-14	14
0113	4	N	1	6	6	6	1	17	17	17	-11	11
0116	4	N	1	6	6	6	1	9	9	9	-3	3
0105	4	N	1	18	18	18	1	19	19	19	-1	1
0102	4	N	1	20	20	20	1	20	20	20	0	0
0103	4	N	1	20	20	20	1	20	20	20	0	0
0119	7	Y	1	6	6	6	1	20	20	20	-14	14
0123	7	Y	1	6	6	6	1	20	20	20	-14	14
0124	7	Y	1	6	6	6	1	20	20	20	-14	14
0108	7	Y	1	15	15	15	1	16	16	16	-1	1
0110	7	Y	1	19	19	19	1	20	20	20	-1	1
0109	7	Y	1	20	20	20	1	13	13	13	7	-7
0117	7	N	1	5	5	5	1	20	20	20	-15	15
0114	7	N	1	6	6	6	1	20	20	20	-14	14
0115	7	N	1	6	6	6	1	18	18	18	-12	12
0101	7	N	1	18	18	18	1	20	20	20	-2	2
0104	7	N	1	20	20	20	1	20	20	20	0	0
0106	7	N	1	20	20	20	1	20	20	20	0	0
67% of the test sections in DNF performed better , 4% of the sections performed worse and 29% of the sections performed same relative to those in the DF region; NC =could not be compared												

Table C.15 Impacts of WF and DF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on longitudinal cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	DF
0111	4	Y	3	9	20	13	1	20	20	20	-7	7
0112	4	Y	2	12	20	16	1	20	20	20	-4	4
0107	4	Y	1	20	20	20	1	20	20	20	0	0
0120	4	Y	1	8	8	8	1	6	6	6	2	-2
0122	4	Y	1	8	8	8	1	6	6	6	2	-2
0121	4	Y	1	9	9	9	1	6	6	6	3	-3
0103	4	N	2	8	14	11	1	20	20	20	-9	9
0105	4	N	2	11	20	16	1	18	18	18	-2	2
0102	4	N	2	17	20	19	1	20	20	20	-1	1
0113	4	N	1	9	9	9	1	6	6	6	2	-2
0116	4	N	2	8	8	8	1	6	6	6	2	-2
0118	4	N	1	9	9	9	1	6	6	6	2	-2
0109	7	Y	3	8	20	12	1	20	20	20	-8	8
0110	7	Y	3	11	20	14	1	19	19	19	-4	4
0108	7	Y	3	7	20	14	1	15	15	15	-1	1
0124	7	Y	2	8	9	9	1	6	6	6	3	-3
0119	7	Y	1	10	10	10	1	6	6	6	4	-4
0123	7	Y	2	10	10	10	1	6	6	6	4	-4
0104	7	N	2	10	10	10	1	20	20	20	-10	10
0106	7	N	3	12	20	17	1	20	20	20	-3	3
0101	7	N	2	12	20	16	1	18	18	18	-2	2
0115	7	N	2	9	9	9	1	6	6	6	3	-3
0117	7	N	2	9	12	11	1	5	5	5	5	-5
0114	7	N	2	7	20	14	1	6	6	6	8	-8
46% of the test sections in DF performed better , 50% of the sections performed worse while 4% perform the same relative to those in the WF region; NC =could not be compared												

Table C.16 Impacts of WNF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on longitudinal cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WNF	DNF
0122	4	Y	4	8	20	16	1	20	20	20	-4	4
0121	4	Y	4	8	20	17	1	20	20	20	-3	3
0107	4	Y	2	19	20	20	1	20	20	20	0	0
0111	4	Y	2	20	20	20	1	20	20	20	0	0
0112	4	Y	2	20	20	20	1	20	20	20	0	0
0120	4	Y	3	8	20	14	1	10	10	10	3	-3
0102	4	N	2	17	19	18	1	20	20	20	-2	2
0103	4	N	2	20	20	20	1	20	20	20	0	0
0105	4	N	2	19	20	19	1	19	19	19	0	0
0113	4	N	4	8	20	17	1	17	17	17	0	0
0118	4	N	3	20	20	20	1	20	20	20	0	0
0116	4	N	3	18	20	19	1	9	9	9	10	-10
0124	7	Y	3	8	20	16	1	20	20	20	-4	4
0123	7	Y	4	12	20	18	1	20	20	20	-2	2
0110	7	Y	2	19	20	20	1	20	20	20	0	0
0119	7	Y	2	20	20	20	1	20	20	20	0	0
0108	7	Y	2	19	20	19	1	16	16	16	3	-3
0109	7	Y	2	20	20	20	1	13	13	13	7	-7
0114	7	N	4	8	20	14	1	20	20	20	-6	6
0117	7	N	4	8	20	16	1	20	20	20	-4	4
0106	7	N	2	17	20	18	1	20	20	20	-2	2
0101	7	N	2	18	20	19	1	20	20	20	-1	1
0115	7	N	3	11	20	17	1	18	18	18	-1	1
0104	7	N	2	20	20	20	1	20	20	20	0	0
42% of the test sections in DNF performed better ,16% of the sections performed worse and 42% performed the same relative to those in the WNF region; NC =could not be compared												

Table C.17 Impacts of WF and WNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on transverse cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	WNF
0120	4	Y	1	13	13	13	3	20	20	20	-7	7
0121	4	Y	1	12	12	12	4	14	20	18	-7	7
0112	4	Y	3	12	20	16	2	20	20	20	-4	4
0111	4	Y	3	14	20	18	2	20	20	20	-2	2
0107	4	Y	1	20	20	20	2	19	20	20	0	0
0122	4	Y	1	20	20	20	4	20	20	20	0	0
0105	4	N	2	8	14	11	2	20	20	20	-9	9
0102	4	N	2	11	20	15	2	15	20	17	-2	2
0103	4	N	2	15	20	18	2	20	20	20	-2	2
0118	4	N	1	20	20	20	3	20	20	20	0	0
0113	4	N	1	20	20	20	3	14	20	18	2	-2
0116	4	N	2	20	20	20	3	15	20	18	2	-2
0110	7	Y	3	15	20	17	2	20	20	20	-3	3
0108	7	Y	3	14	20	18	2	20	20	20	-2	2
0109	7	Y	3	16	20	19	2	20	20	20	-1	1
0119	7	Y	1	20	20	20	2	20	20	20	0	0
0123	7	Y	2	20	20	20	4	20	20	20	0	0
0124	7	Y	2	20	20	20	3	20	20	20	0	0
0104	7	N	3	11	20	15	2	20	20	20	-5	5
0101	7	N	2	12	20	16	2	20	20	20	-4	4
0106	7	N	3	11	20	17	2	20	20	20	-3	3
0115	7	N	2	20	20	20	3	20	20	20	0	0
0117	7	N	2	20	20	20	4	20	20	20	0	0
0114	7	N	2	20	20	20	3	14	20	18	2	-2
54% of the test sections in WNF performed better relative to those in WF region, 13% of the sections performed worse and 33% performed the same relative to those in the WF region; NC =could not be compared												

Table C.18 Impacts of DF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on transverse cracking

SHRP ID	AC thickness (inch)	Drainage	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	DF	DNF
0122	4	Y	1	8	8	8	1	20	20	20	-12	12
0120	4	Y	1	7	7	7	1	10	10	10	-2	2
0121	4	Y	1	8	8	8	1	10	10	10	-2	2
0111	4	Y	1	19	19	19	1	20	20	20	-1	1
0107	4	Y	1	16	16	16	1	15	15	15	0	0
0112	4	Y	1	20	20	20	1	20	20	20	0	0
0102	4	N	1	20	20	20	1	20	20	20	0	0
0103	4	N	1	20	20	20	1	20	20	20	0	0
0105	4	N	1	20	20	20	1	20	20	20	0	0
0116	4	N	1	20	20	20	1	20	20	20	0	0
0118	4	N	1	20	20	20	1	20	20	20	0	0
0113	4	N	1	11	11	11	1	10	10	10	1	-1
0123	7	Y	1	10	10	10	1	20	20	20	-10	10
0124	7	Y	1	8	8	8	1	17	17	17	-9	9
0109	7	Y	1	14	14	14	1	20	20	20	-6	6
0119	7	Y	1	10	10	10	1	15	15	15	-5	5
0108	7	Y	1	19	19	19	1	20	20	20	-1	1
0110	7	Y	1	20	20	20	1	20	20	20	0	0
0115	7	N	1	12	12	12	1	16	16	16	-4	4
0114	7	N	1	10	10	10	1	12	12	12	-2	2
0104	7	N	1	20	20	20	1	20	20	20	0	0
0106	7	N	1	20	20	20	1	20	20	20	0	0
0101	7	N	1	19	19	19	1	18	18	18	2	-2
0117	7	N	1	20	20	20	1	16	16	16	4	-4
46% of the test sections in DNF performed better , 12% of the sections performed worse and 42% performed the same relative to those in the DF region; NC =could not be compared												

Table C.19 Impacts of WF and DF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on transverse cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WF	DF
0112	4	Y	3	12	20	16	1	20	20	20	-4	4
0111	4	Y	3	14	20	18	1	19	19	19	-1	1
0121	4	Y	1	12	12	12	1	8	8	8	3	-3
0107	4	Y	1	20	20	20	1	16	16	16	4	-4
0120	4	Y	1	13	13	13	1	7	7	7	6	-6
0122	4	Y	1	20	20	20	1	8	8	8	12	-12
0105	4	N	2	8	14	11	1	20	20	20	-9	9
0102	4	N	2	11	20	15	1	20	20	20	-5	5
0103	4	N	2	15	20	18	1	20	20	20	-2	2
0116	4	N	2	20	20	20	1	20	20	20	0	0
0118	4	N	1	20	20	20	1	20	20	20	0	0
0113	4	N	1	20	20	20	1	11	11	11	9	-9
0110	7	Y	3	15	20	17	1	20	20	20	-3	3
0108	7	Y	3	14	20	18	1	19	19	19	-1	1
0109	7	Y	3	16	20	19	1	14	14	14	5	-5
0119	7	Y	1	20	20	20	1	10	10	10	10	-10
0123	7	Y	2	20	20	20	1	10	10	10	10	-10
0124	7	Y	2	20	20	20	1	8	8	8	12	-12
0104	7	N	3	11	20	15	1	20	20	20	-5	5
0101	7	N	2	12	20	16	1	19	19	19	-3	3
0106	7	N	3	11	20	17	1	20	20	20	-3	3
0117	7	N	2	20	20	20	1	20	20	20	0	0
0115	7	N	2	20	20	20	1	12	12	12	8	-8
0114	7	N	2	20	20	20	1	10	10	10	10	-10
42% of the test sections in DF performed better , 46% of the sections performed worse while 12% performed the same relative to those in the WF region;												

Table C.20 Impacts of WNF and DNF climatic zones on pavement performance of LTPP SPS-1 test sections in terms of remaining structural period (RSP) based on transverse cracking

SHRP ID	AC thickness (inch)	Drainage	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
			Number of sections	RSP (year)			Number of sections	RSP (year)				
				Min	Max	Avg		Min	Max	Avg	WNF	DNF
0111	4	Y	2	20	20	20	1	20	20	20	0	0
0112	4	Y	2	20	20	20	1	20	20	20	0	0
0122	4	Y	4	20	20	20	1	20	20	20	0	0
0107	4	Y	2	19	20	20	1	15	15	15	4	-4
0121	4	Y	4	14	20	18	1	10	10	10	8	-8
0120	4	Y	3	20	20	20	1	10	10	10	10	-10
0102	4	N	2	15	20	17	1	20	20	20	-3	3
0116	4	N	3	15	20	18	1	20	20	20	-2	2
0103	4	N	2	20	20	20	1	20	20	20	0	0
0105	4	N	2	20	20	20	1	20	20	20	0	0
0118	4	N	3	20	20	20	1	20	20	20	0	0
0113	4	N	3	14	20	18	1	10	10	10	8	-8
0123	7	Y	4	20	20	20	1	20	20	20	0	0
0108	7	Y	2	20	20	20	1	20	20	20	0	0
0109	7	Y	2	20	20	20	1	20	20	20	0	0
0110	7	Y	2	20	20	20	1	20	20	20	0	0
0124	7	Y	3	20	20	20	1	17	17	17	3	-3
0119	7	Y	2	20	20	20	1	15	15	15	5	-5
0104	7	N	2	20	20	20	1	20	20	20	0	0
0106	7	N	2	20	20	20	1	20	20	20	0	0
0101	7	N	2	20	20	20	1	18	18	18	2	-2
0117	7	N	4	20	20	20	1	16	16	16	4	-4
0115	7	N	3	20	20	20	1	16	16	16	4	-4
0114	7	N	3	14	20	18	1	12	12	12	6	-6
8% of the test sections in DNF performed better , 42% of the sections performed worse and 50% performed the same relative to those in the WNF region; NC =could not be compared												

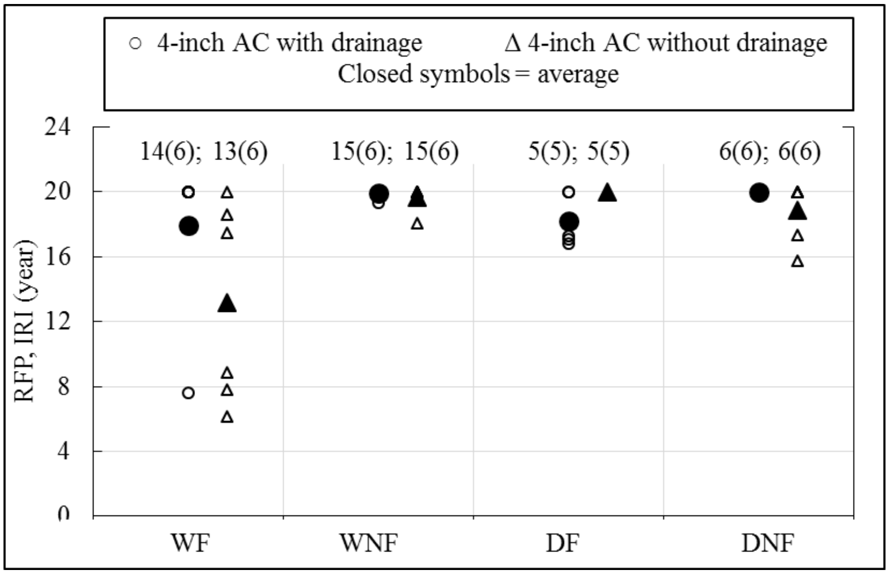

Figure C.1 Comparison of the average RFP of test sections having 4-inch thick AC layer and drainable and un-drainable bases

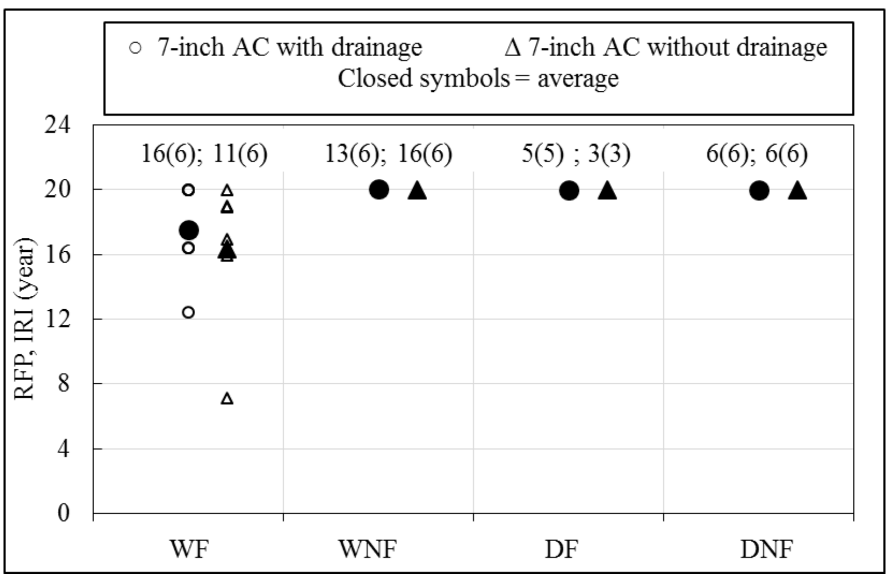

Figure C.2 Comparison of the average RFP of test sections having 7-inch thick AC layer and drainable and un-drainable bases

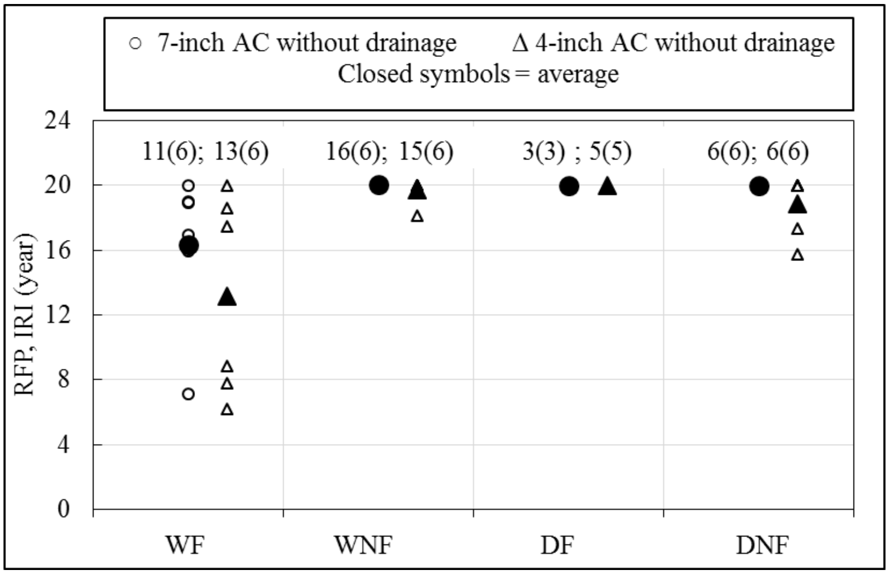

Figure C.3 Comparison of the average RFP of test sections having un-drainable bases and 7-inch and 4-inch thick AC layers

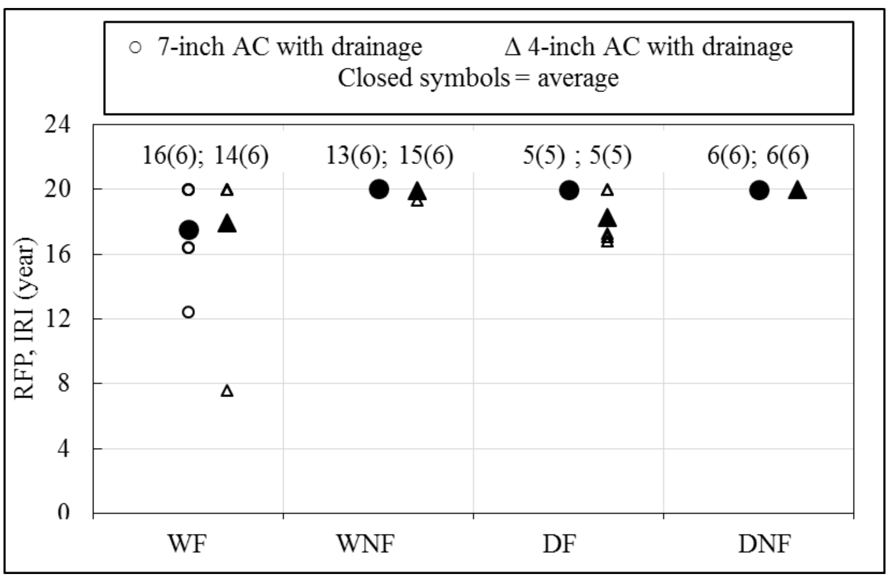

Figure C.4 Comparison of the average RFP of test sections having drainable bases and 7-inch and 4-inch thick AC layers

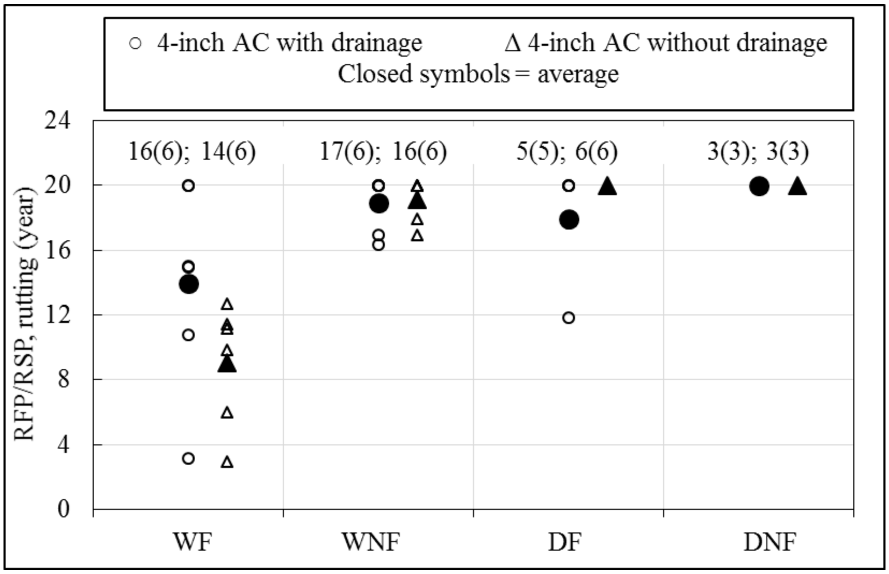

Figure C.5 Comparison of the average RFP/RSP of test sections having 4-inch thick AC layer and drainable and un-drainable bases

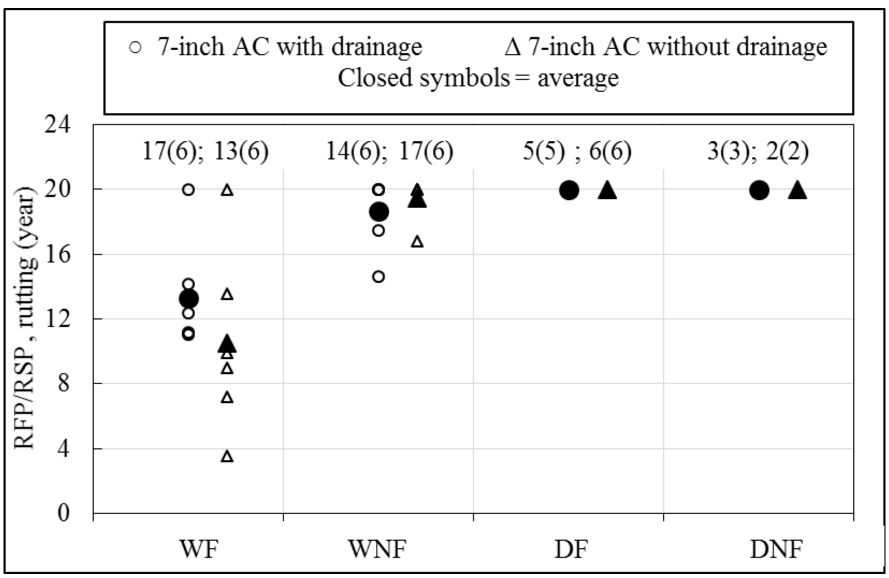

Figure C.6 Comparison of the average RFP/RSP of test sections having 7-inch thick AC layer and drainable and un-drainable bases

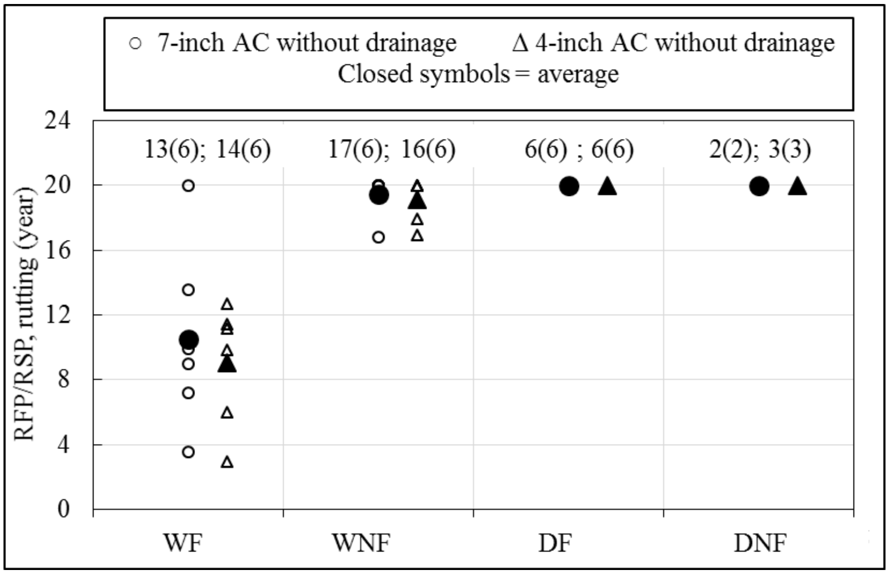

Figure C.7 Comparison of the average RFP/RSP of test sections having 7-inch and 4-inch thick AC layers with un-drainable bases

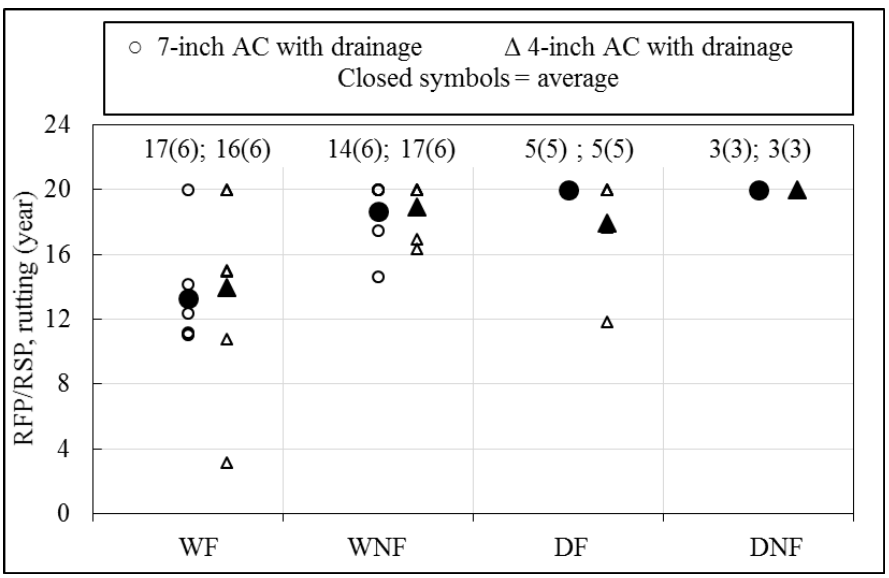

Figure C.8 Comparison of the average RFP/RSP of test sections having 7-inch and 4-inch thick AC layers with drainable bases

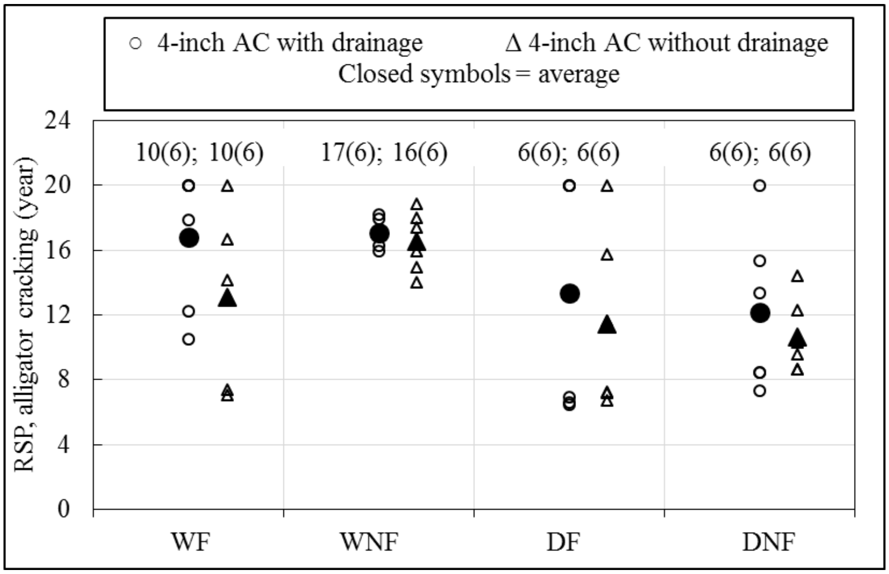

Figure C.9 Comparison of the average RSP of 4-inch AC layer test sections with drainable and un-drainable bases

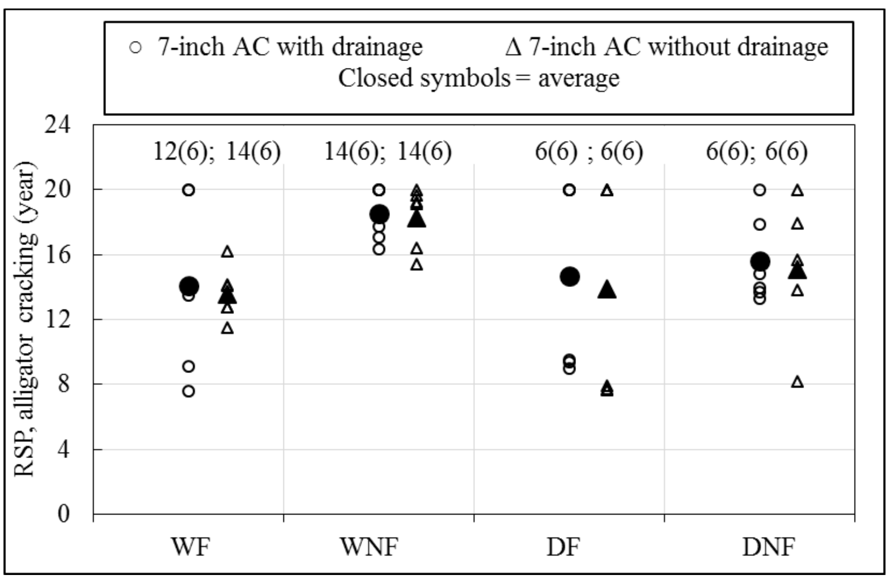

Figure C.10 Comparison of the average RSP of 7-inch AC layer test sections with drainable and un-drainable bases

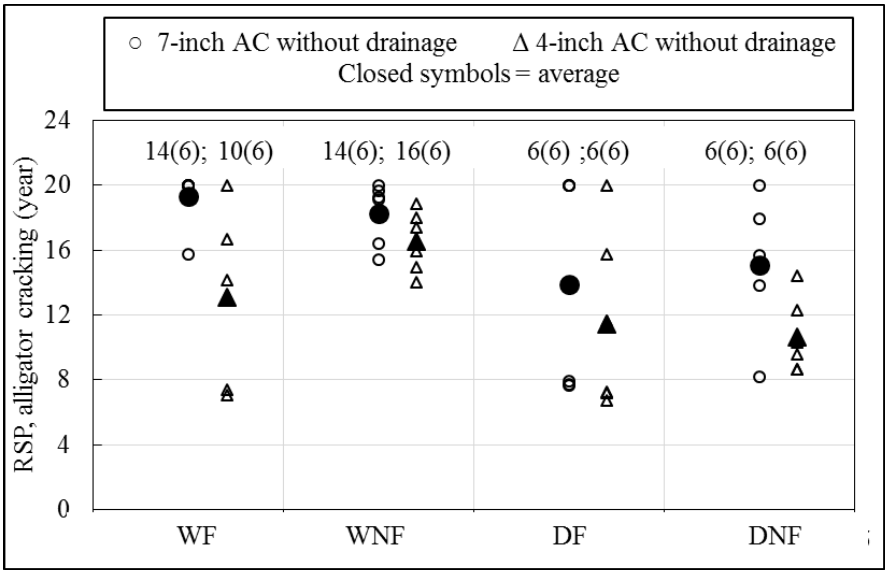

Figure C.11 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with un-drainable bases

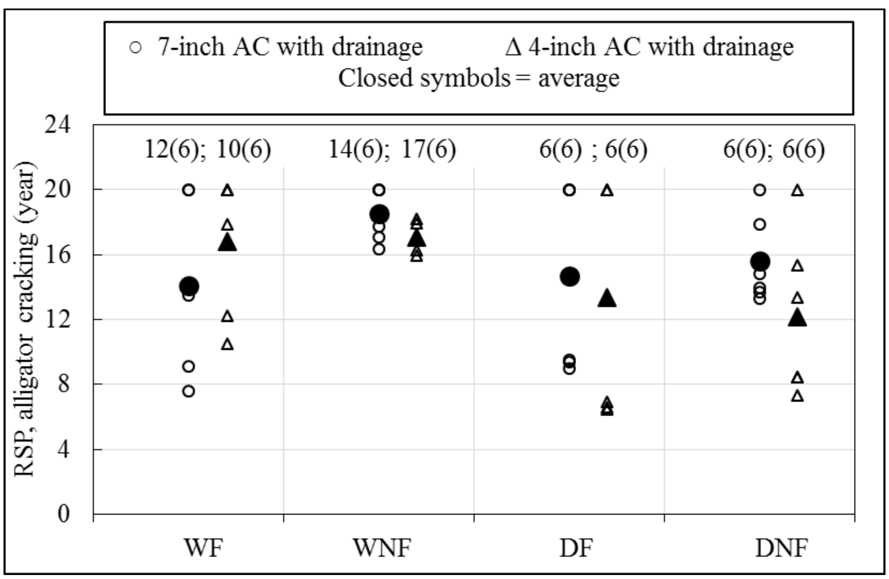

Figure C.12 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with drainable bases

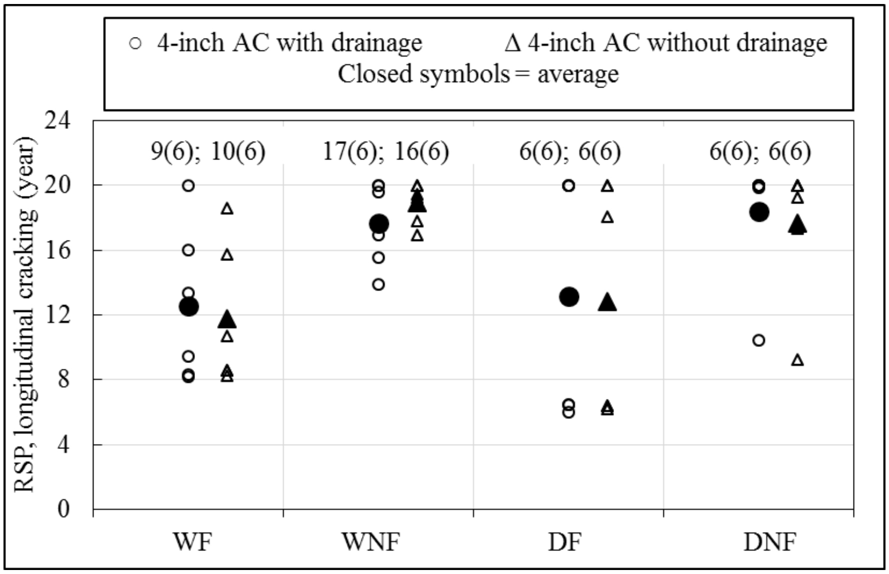

Figure C.13 Comparison of the average RSP of 4-inch AC layer test sections with drainable and un-drainable bases

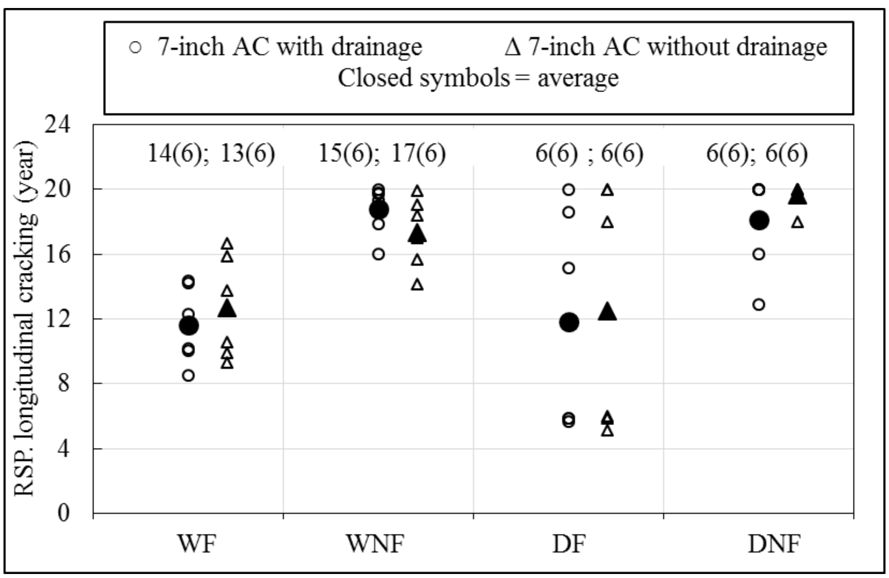

Figure C.14 Comparison of the average RSP of 7-inch AC layer test sections with drainable and un-drainable bases

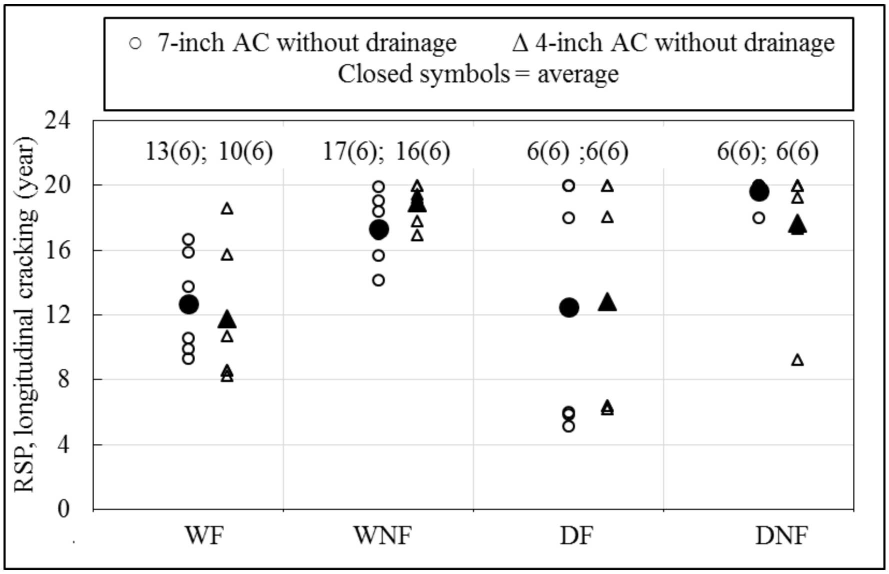

Figure C.15 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with un-drainable bases

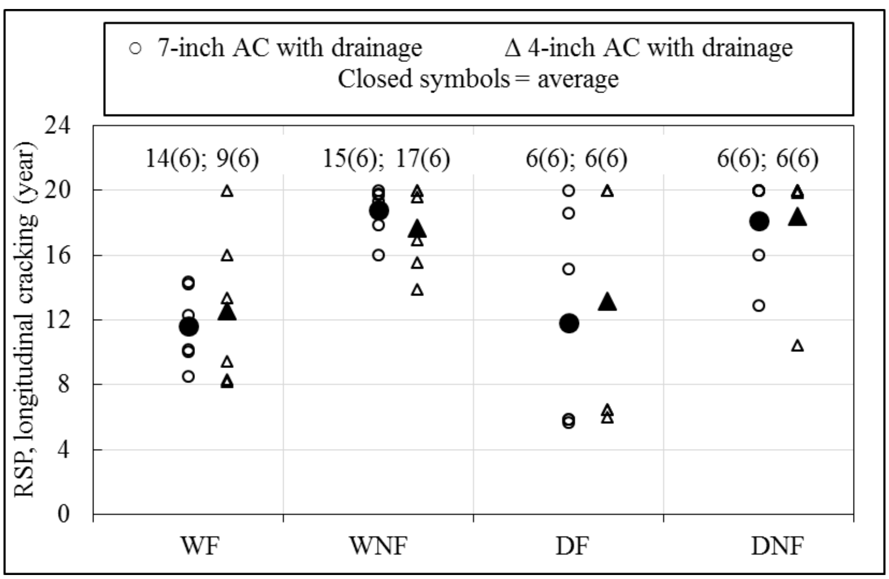

Figure C.16 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with drainable bases

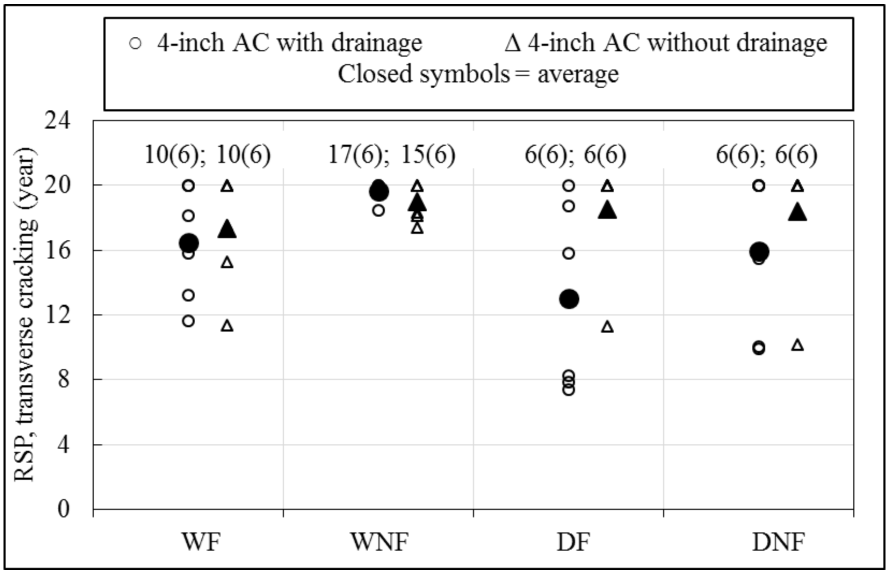

Figure C.17 Comparison of the average RSP of 4-inch AC layer test sections with drainable and un-drainable bases

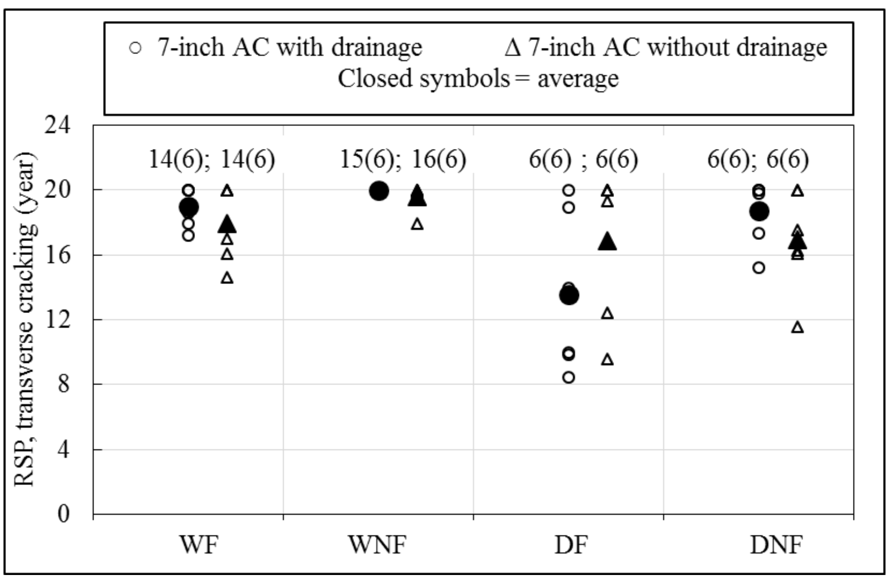

Figure C.18 Comparison of the average RSP of 7-inch AC layer test sections with drainable and un-drainable bases

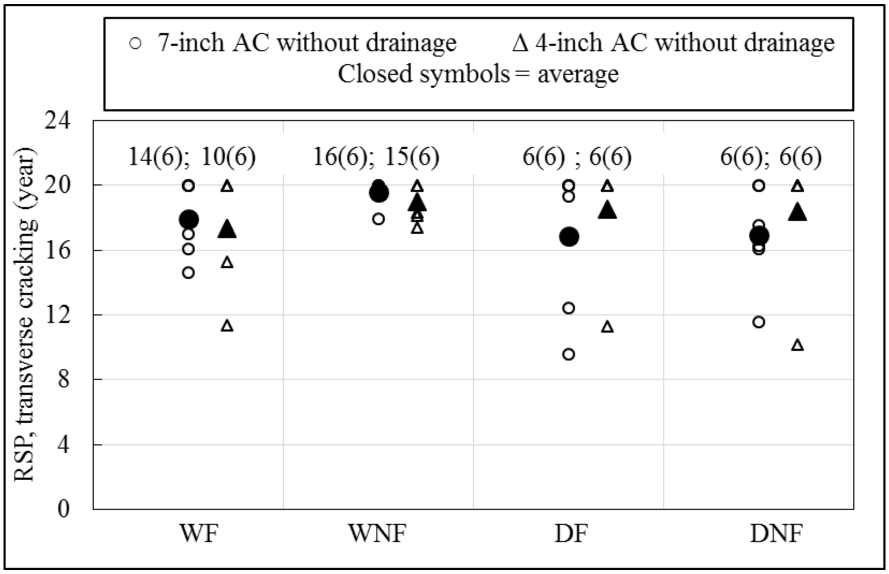

Figure C.19 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with un-drainable bases

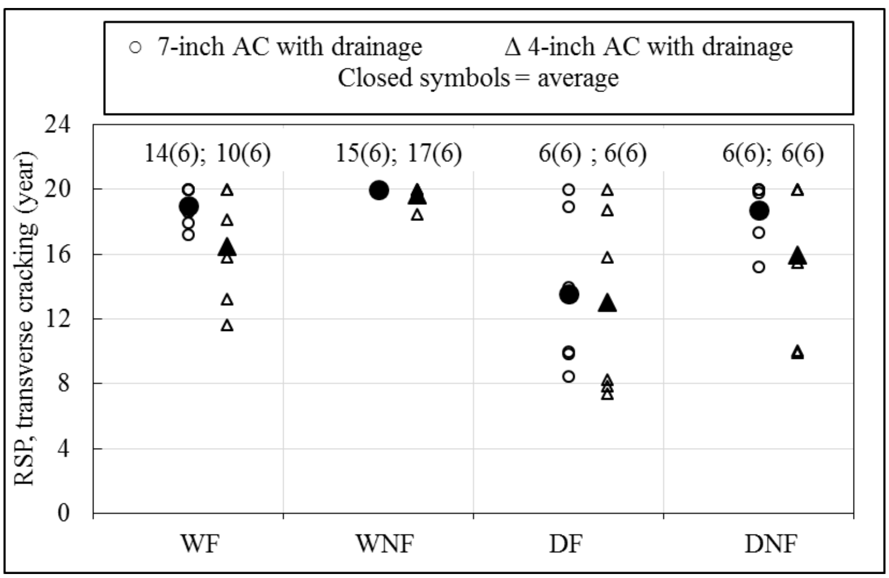

Figure C.20 Comparison of the average RSP of 7-inch AC layer and 4-inch AC layer test sections with drainable bases

APPENDIX D

Results of the Analyses of LTPP SPS-3 Test sections
Impacts of the pavement distress before treatment on pavement performance

APPENDIX D

Results of the Analyses of LTPP SPS-3 Test sections

Impacts of the pavement distress before treatment on pavement performance

The pavement distress and condition data of LTPP SPS-3 test sections were analyzed to determine the impacts of four pavement treatment types (thin AC overlay, slurry seal, crack seal, and aggregate seal coat), environmental conditions, and the pavement condition and distress before treatment on the pavement performance after treatment. The results are presented and discussed in Chapter 5. Sixteen of the twenty figures showing the impacts of the pavement conditions and distress before treatment on the pavement performance after treatments are shown in Figures D.1 through D.16.

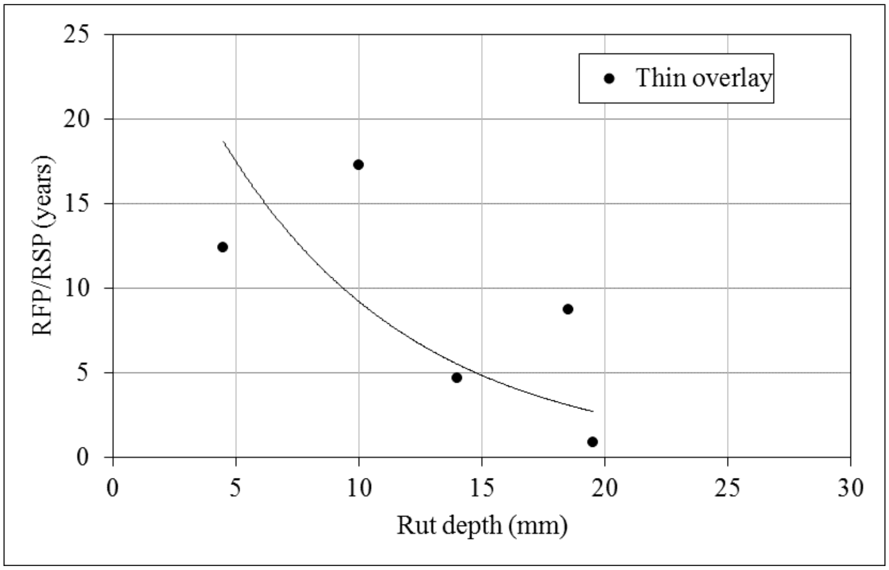

Figure D.1 After treatment RFP/RSP versus before treatment rut depth of SPS-3 test sections subjected to thin overlay

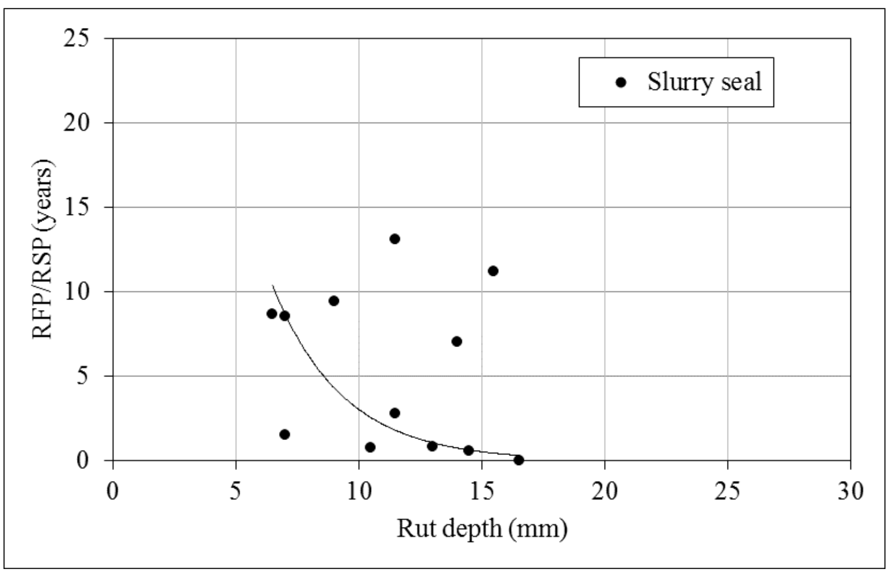

Figure D.2 After treatment RFP/RSP versus before treatment rut depth of SPS-3 test sections subjected to slurry seal

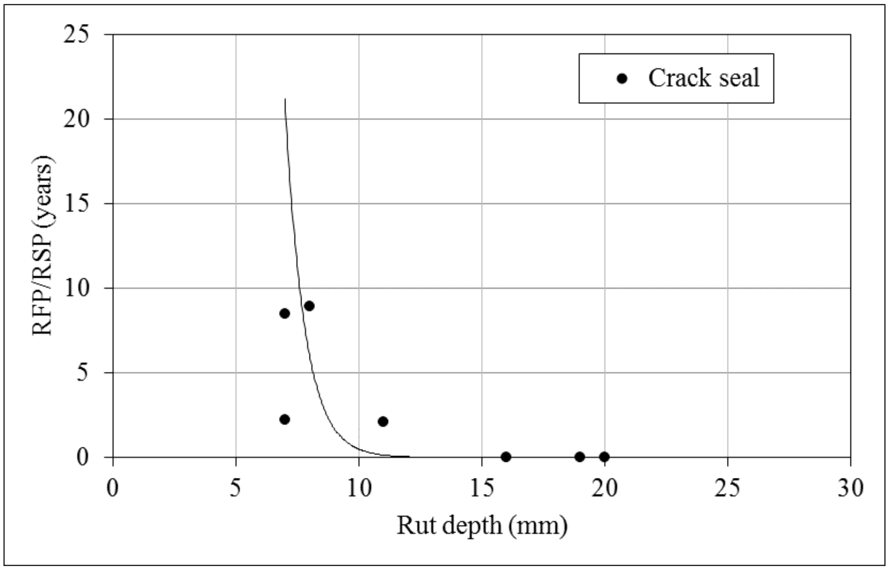

Figure D.3 After treatment RFP/RSP versus before treatment rut depth of SPS-3 test sections subjected to crack seal

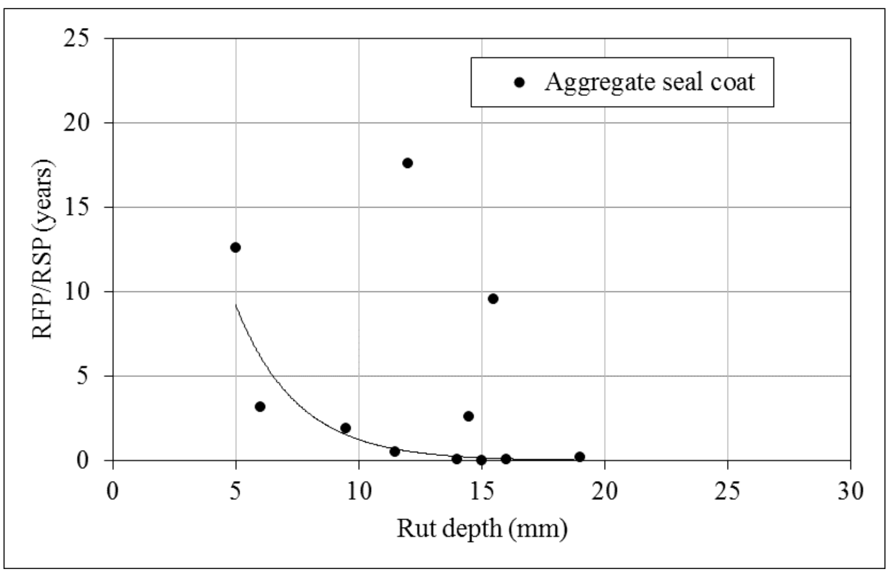

Figure D.4 After treatment RFP/RSP versus before treatment rut depth of SPS-3 test sections subjected to aggregate seal coat

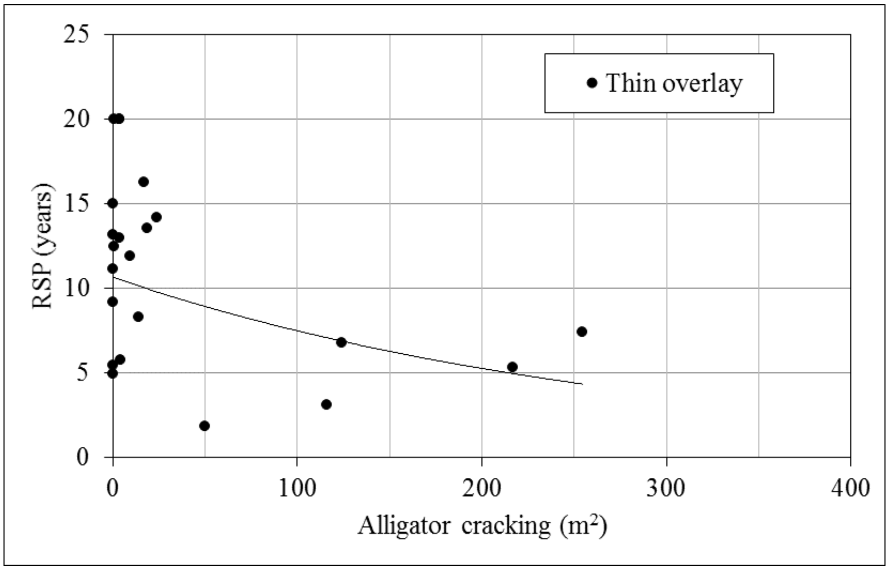

Figure D.5 After treatment RSP versus before treatment alligator cracking of SPS-3 test sections subjected to thin overlay

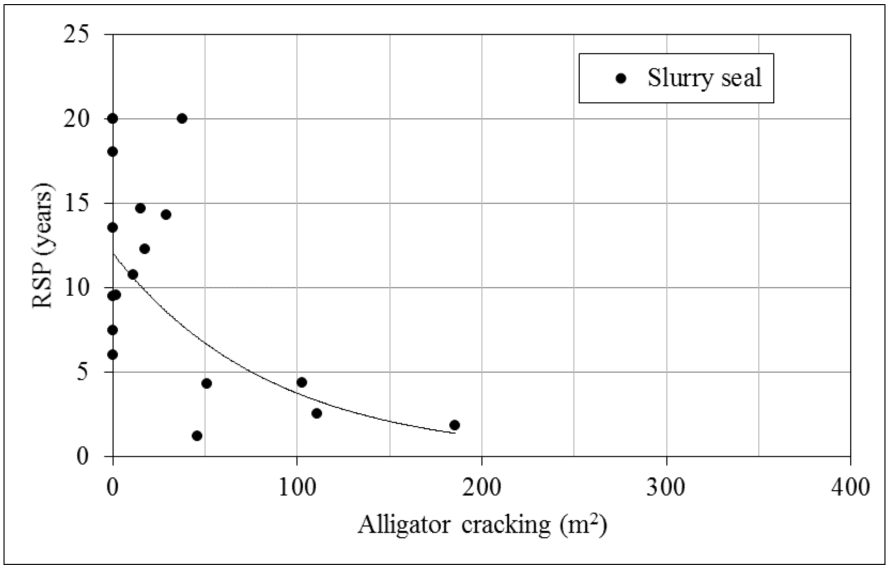

Figure D.6 After treatment RSP versus before treatment alligator cracking of SPS-3 test sections subjected to slurry seal

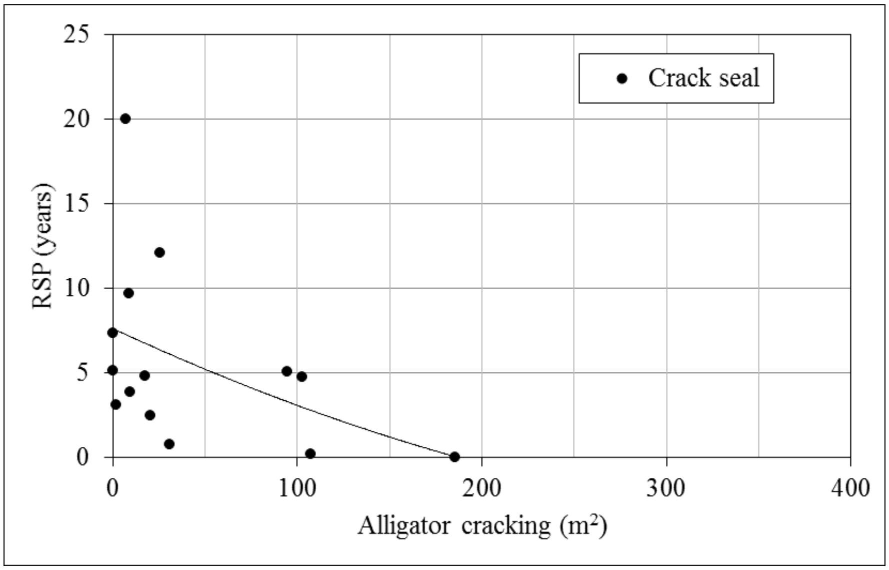

Figure D.7 After treatment RSP versus before treatment alligator cracking of SPS-3 test sections subjected to crack seal

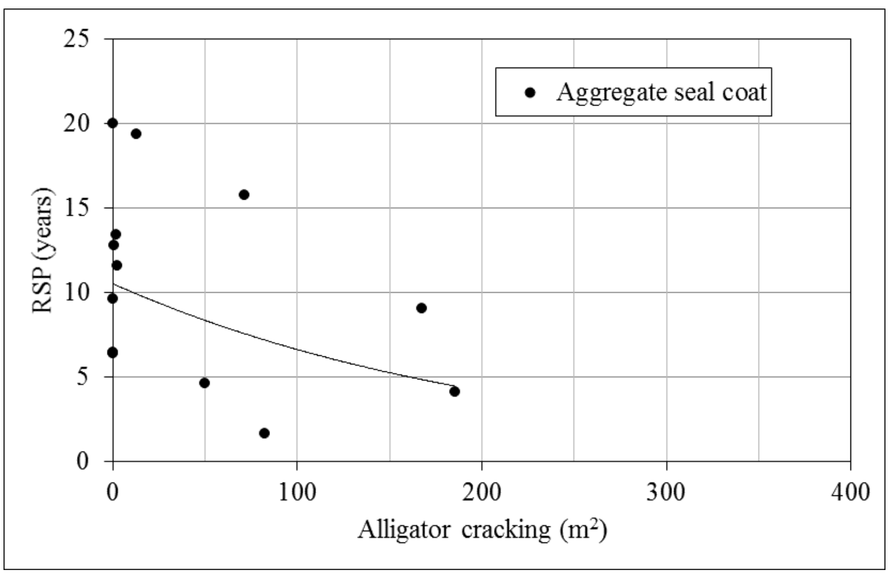

Figure D.8 After treatment RSP versus before treatment alligator cracking of SPS-3 test sections subjected to aggregate seal coat

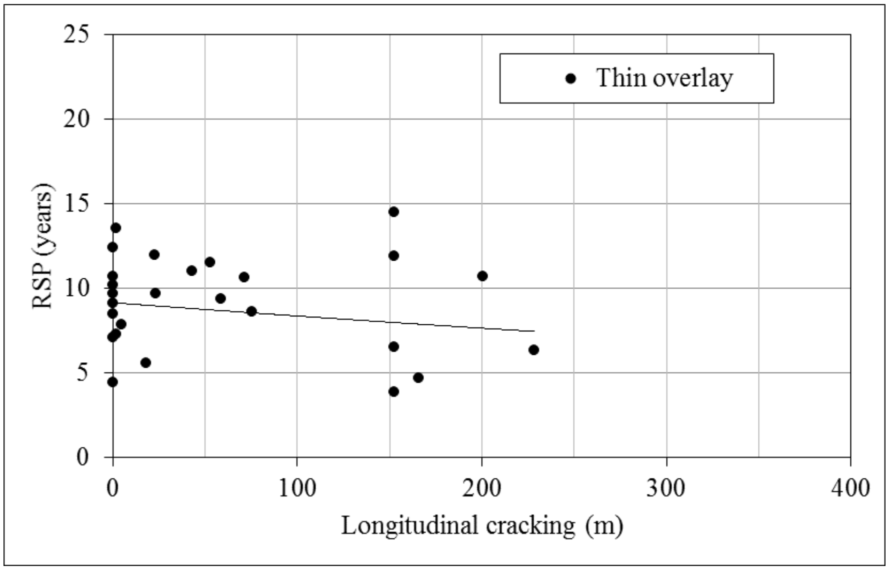

Figure D.9 After treatment RSP versus before treatment longitudinal cracking of SPS-3 test sections subjected to thin overlay

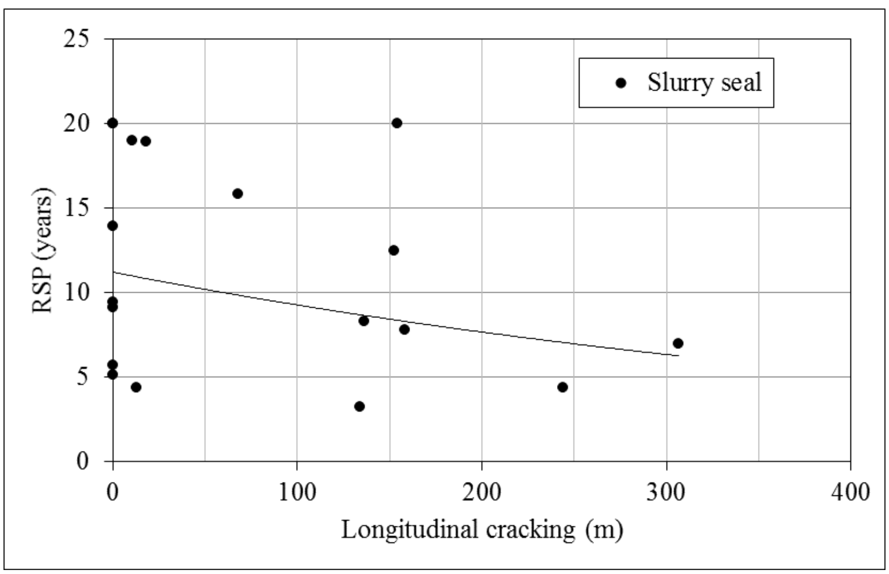

Figure D.10 After treatment RSP versus before treatment longitudinal cracking of SPS-3 test sections subjected to slurry seal

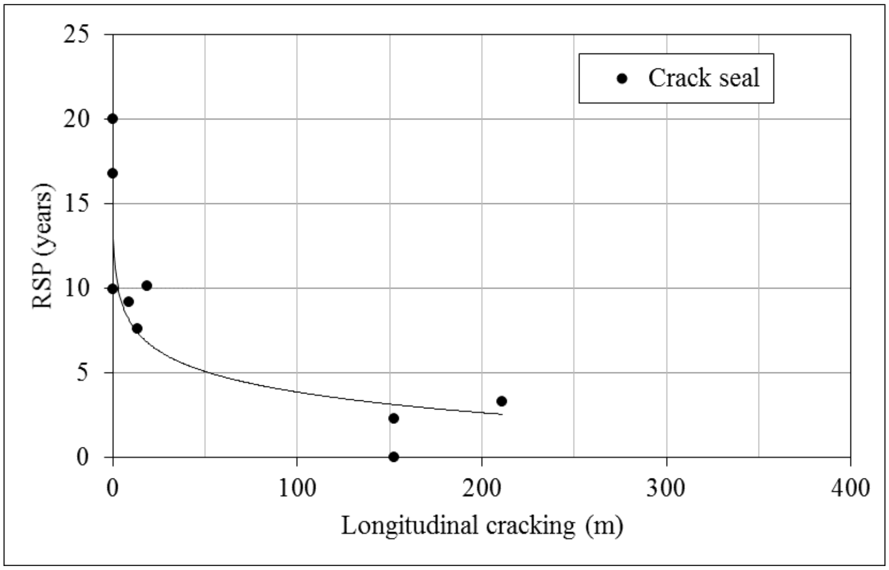

Figure D.11 After treatment RSP versus before treatment longitudinal cracking of SPS-3 test sections subjected to crack seal

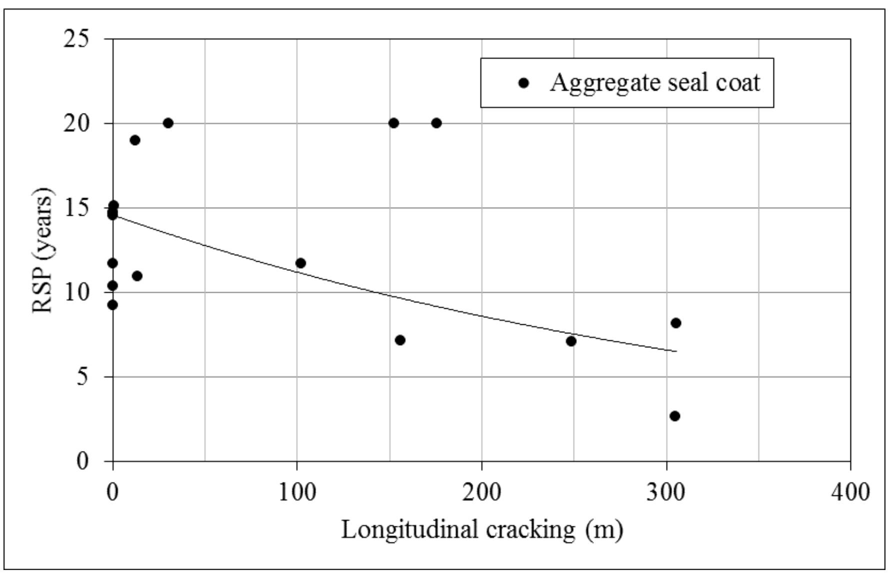

Figure D.12 After treatment RSP versus before treatment longitudinal cracking of SPS-3 test sections subjected to aggregate seal coat

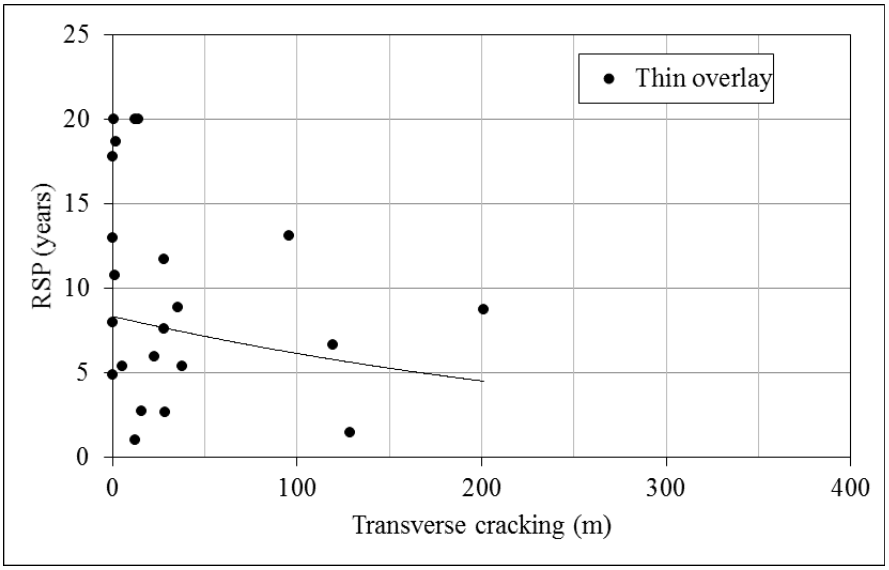

Figure D.13 After treatment RSP versus before treatment transverse cracking of SPS-3 test sections subjected to thin overlay

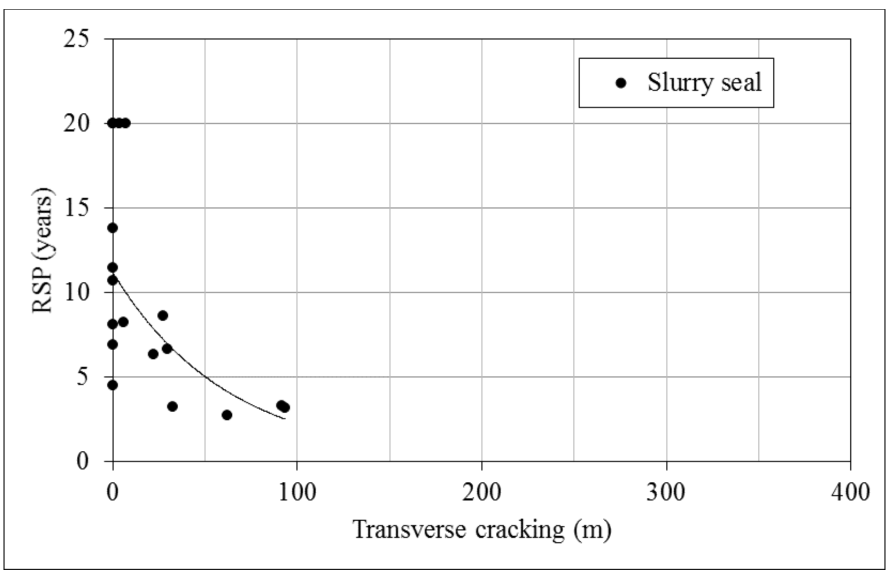

Figure D.14 After treatment RSP versus before treatment transverse cracking of SPS-3 test sections subjected to slurry seal

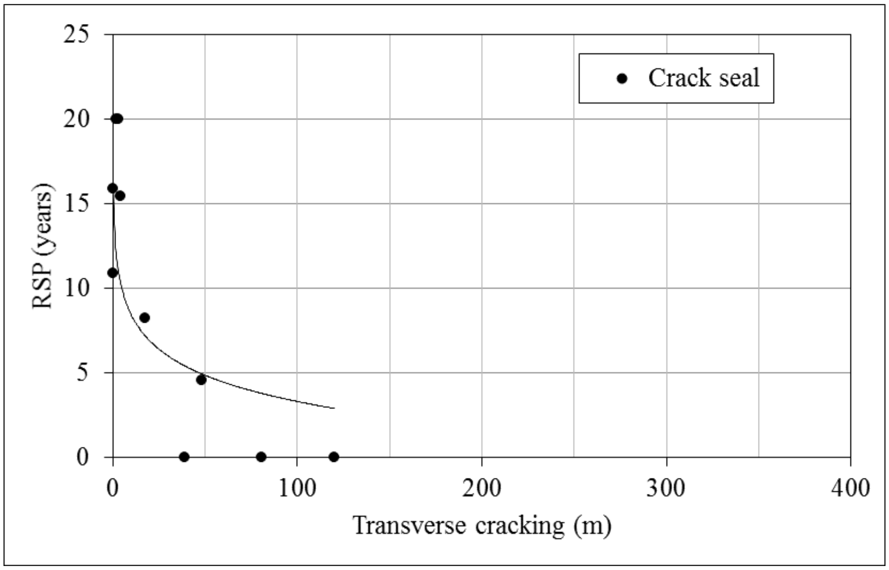

Figure D.15 After treatment RSP versus before treatment transverse cracking of SPS-3 test sections subjected to crack seal

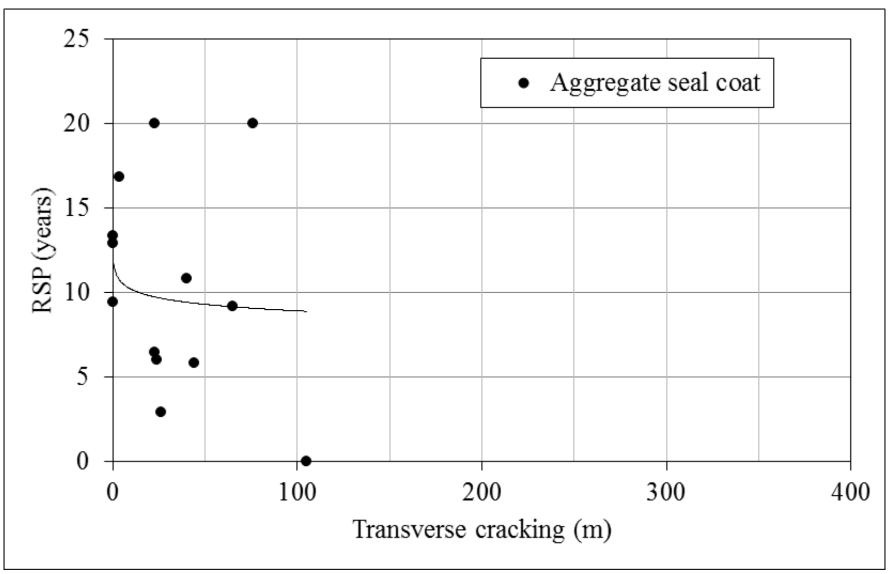

Figure D.16 After treatment RSP versus before treatment transverse cracking of SPS-3 test sections subjected to aggregate seal coat

APPENDIX E

Detailed Results of the Analyses of LTPP SPS-2 Test sections Impacts of Pavement Design Variables and Climatic Regions

APPENDIX E

Detailed Results of the Analyses of LTPP SPS-2 Test sections

Impacts of Pavement Design Variables and Climatic Regions

The pavement condition and distress data of LTPP SPS-2 test sections were analyzed to determine the impacts of the pavement design factors and climatic regions on pavement performance. The design factors included in the analyses are the thickness of the Portland cement concrete (PCC) slab, the presence or absence of base layer drainage, concrete flexural strength, and slab width. The test sections are located in the four climatic regions; wet-freeze (WF), wet-no-freeze (WNF), dry-freeze (DF), and dry-no-freeze (DNF), and

The data in the last two columns of Tables E.1 through E.12 express the comparative differences in pavement performance (in terms of the remaining functional period (RFP) and the remaining structural period (RSP)) between test sections located in the indicated climatic zones. For example, the last two columns in Table E.1 provide the comparative difference between the average RFP values in the wet-freeze and in the wet-no-freeze zones. A negative number implies worse performance whereas a positive means better performance. To illustrate, the four test sections having SHRP ID 0205 (second row in Table E.1), PCC slab thickness of 8-inch, undrainable bases, slab strength of 3.6 MPa, and slab width of 3.66 m, the average RFP (based on IRI) of the two sections located in the wet-freeze region is one year less than the average RFP of the two test sections located in the wet-no-freeze region.

Table E.1 Impacts of WF and WNF climatic regions on pavement performance in terms of the remaining functional period (RFP) based on IRI of LTPP SPS-2 test sections

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RFP (year)	
					No.	RFP (year)			No.	RFP (year)				
						Min	Max	Avg		Min	Max	Avg	WF	WNF
0201	8	N	3.8	3.66	2	20	20	20	2	20	20	20	0	0
0205	8	N	3.8	3.66	2	18	20	19	2	20	20	20	-1	1
0213	8	N	3.8	4.27	3	9	20	16	1	20	20	20	-4	4
0217	8	N	3.8	4.27	3	7	20	16	1	18	18	18	-3	3
0214	8	N	6.2	3.66	4	7	20	17	1	15	15	15	1	-1
0218	8	N	6.2	3.66	3	4	20	15	1	20	20	20	-5	5
0202	8	N	6.2	4.27	2	20	20	20	2	20	20	20	0	0
0206	8	N	6.2	4.27	2	19	20	19	2	20	20	20	-1	1
0209	8	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	3	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	3	20	20	20	1	20	20	20	0	0
0210	8	Y	6.2	4.27	2	20	20	20	0	0	0	-	NC	NC
0215	11	N	3.8	3.66	4	7	20	17	1	20	20	20	-3	3
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	2	20	20	20	2	20	20	20	0	0
0216	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	3	19	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	3	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	1	20	20	20	2	20	20	20	0	0
0224	11	Y	6.2	4.27	2	20	20	20	0	0	0	-	NC	NC
26% of test sections in WNF performed better; 4% performed worse and 70% performed the same relative to those in the WF region; NC = Could not be compared; No. = number of test sections;														

Table E.2 Impacts of DF and DNF climatic zones on pavement performance in terms of remaining functional period (RFP) based on IRI of LTPP SPS-2 test sections

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RFP (year)	
					No.	RFP (year)			No.	RFP (year)				
						Min	Max	Avg		Min	Max	Avg	DF	DNF
0201	8	N	3.8	3.66	1	20	20	20	1	13	13	13	7	-7
0205	8	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0213	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0217	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0214	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	1	20	20	20	0	0	0	-	NC	NC
0202	8	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0209	8	Y	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	0	0	0	-	1	20	20	20	NC	NC
0210	8	Y	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	1	20	20	20	1	16	16	16	4	-4
0207	11	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	0	0	0	-	1	20	20	20	NC	NC
0224	11	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC

10 % performed worse in DNF region and 90 % performed the same relative to those in the DF region; NC = Could not be compared; No. = number of test sections;

Table E.3 Impacts of WF and DF climatic zones on pavement performance in terms of remaining functional period (RFP) based on IRI of LTPP SPS-2 test sections

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RFP (year)	
					No.	RFP (year)			No.	RFP (year)			WF	DF
						Min	Max	Avg		Min	Max	Avg		
0201	8	N	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0205	8	N	3.8	3.66	2	18	20	19	1	20	20	20	-1	1
0213	8	N	3.8	4.27	3	9	20	16	1	20	20	20	-4	4
0217	8	N	3.8	4.27	3	7	20	16	1	20	20	20	-4	4
0214	8	N	6.2	3.66	4	7	20	17	1	20	20	20	-3	3
0218	8	N	6.2	3.66	3	4	20	15	1	20	20	20	-5	5
0202	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	2	19	20	19	1	20	20	20	-1	1
0209	8	Y	3.8	3.66	1	20	20	20	2	20	20	20	0	0
0221	8	Y	3.8	4.27	3	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	3	20	20	20	0	0	0	-	NC	NC
0210	8	Y	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0215	11	N	3.8	3.66	4	7	20	17	1	20	20	20	-3	3
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	3	19	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	3	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	1	20	20	20	0	0	0	-	NC	NC
0224	11	Y	6.2	4.27	2	20	20	20	0	0	0	-	NC	NC

32% of test sections in DF performed better and 68% performed the same relative to those in the WF region; NC = Could not be compared; No. = number of test sections;

Table E.4 Impacts of WNF and DNF climatic zones on pavement performance in terms of RFP based on IRI of LTPP SPS-2 test sections

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RFP (year)	
					No.	RFP (year)			No.	RFP (year)				
						Min	Max	Avg		Min	Max	Avg	WNF	DNF
0201	8	N	3.8	3.66	2	20	20	20	1	13	13	13	7	-7
0205	8	N	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0213	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0217	8	N	3.8	4.27	1	18	18	18	1	20	20	20	-2	2
0214	8	N	6.2	3.66	1	15	15	15	1	20	20	20	-5	5
0218	8	N	6.2	3.66	1	20	20	20	0	0	0	-	NC	NC
0202	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0209	8	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0210	8	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	1	16	16	16	4	-4
0207	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
9% of test sections in WNF performed better; 9% performed worse and 92% performed the same relative to those in the DNF region; NC = Could not be compared; No. = number of test sections;														

Table E.5 Impacts of WF and WNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on longitudinal cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WF	WNF
0201	8	N	3.8	3.66	1	20	20	20	2	20	20	20	0	0
0205	8	N	3.8	3.66	2	15	17	16	2	18	20	19	-3	3
0213	8	N	3.8	4.27	4	20	20	20	1	11	11	11	9	-9
0217	8	N	3.8	4.27	3	7	20	14	1	15	15	15	-1	1
0214	8	N	6.2	3.66	4	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	4	6	20	16	1	14	14	14	2	-2
0202	8	N	6.2	4.27	2	20	20	20	2	20	20	20	0	0
0206	8	N	6.2	4.27	2	20	20	20	2	20	20	20	0	0
0209	8	Y	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	4	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	4	20	20	20	1	20	20	20	0	0
0210	8	Y	6.2	4.27	2	20	20	20	0	0	0	-	NC	NC
0215	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0204	11	N	6.2	3.66	1	15	15	15	2	20	20	20	-5	5
0208	11	N	6.2	3.66	2	20	20	20	2	20	20	20	0	0
0216	11	N	6.2	4.27	3	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0212	11	Y	6.2	3.66	2	20	20	20	2	20	20	20	0	0
0224	11	Y	6.2	4.27	4	20	20	20	0	0	0	-	NC	NC
13% of the test sections in WNF performed better, 9% performed worse while 78% perform same relative to those in WF region; NC =could not be compared; No. = number of test sections;														

Table E.6 Impacts of DF and DNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on longitudinal cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	DF	DNF
0201	8	N	3.8	3.66	1	20	20	20	1	7	7	7	13	-13
0205	8	N	3.8	3.66	2	8	20	14	1	20	20	20	-6	6
0213	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0217	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0214	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0202	8	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0209	8	Y	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	0	0	0	-	1	20	20	20	NC	NC
0210	8	Y	6.2	4.27	2	17	20	19	1	20	20	20	-1	1
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	15	20	17	1	20	20	20	-3	3
0207	11	N	3.8	4.27	0	0	0	-	1	20	20	20	NC	NC
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	14	14	14	1	20	20	20	-6	6
0220	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	1	20	20	20	1	20	20	20	0	0

18% of the test sections in DNF performed better , 5% of the sections performed worse and 77% of the sections performed same relative to those in the DF; NC =could not be compared; No. = number of test sections;

Table E.7 Impacts of WF and DF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on longitudinal cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WF	DF
0201	8	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0205	8	N	3.8	3.66	2	15	17	16	2	8	20	14	2	-2
0213	8	N	3.8	4.27	4	20	20	20	1	20	20	20	0	0
0217	8	N	3.8	4.27	3	7	20	14	1	20	20	20	-6	6
0214	8	N	6.2	3.66	4	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	4	6	20	16	1	20	20	20	-4	4
0202	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0209	8	Y	3.8	3.66	2	20	20	20	2	20	20	20	0	0
0221	8	Y	3.8	4.27	4	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	4	20	20	20	0	0	0	-	NC	NC
0210	8	Y	6.2	4.27	2	20	20	20	2	17	20	19	1	-1
0215	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	2	15	20	17	3	-3
0207	11	N	3.8	4.27	2	20	20	20	0	0	0	-	NC	NC
0204	11	N	6.2	3.66	1	15	15	15	1	20	20	20	-5	5
0208	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	3	20	20	20	1	14	14	14	6	-6
0220	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0212	11	Y	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	4	20	20	20	1	20	20	20	0	0
14% of the test sections in DF performed better , 18% of the sections performed worse while 68% perform the same relative to those in the WF region; NC =could not be compared; No. = number of test sections;														

Table E.8 Impacts of WNF and DNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on longitudinal cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WNF	DNF
0201	8	N	3.8	3.66	2	20	20	20	1	7	7	7	13	-13
0205	8	N	3.8	3.66	2	18	20	19	1	20	20	20	-1	1
0213	8	N	3.8	4.27	1	11	11	11	1	20	20	20	-9	9
0217	8	N	3.8	4.27	1	15	15	15	1	20	20	20	-5	5
0214	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	1	14	14	14	1	20	20	20	-6	6
0202	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0206	8	N	6.2	4.27	2	20	20	20	1	20	20	20	0	0
0209	8	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0210	8	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
18% of the test sections in DNF performed better ,4% of the sections performed worse and 78% performed the same relative to those in the WNF region; NC =could not be compared; No. = number of test sections;														

Table E.9 Impacts of WF and WNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on transverse cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Wet-no-freeze (WNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WF	WNF
0201	8	N	3.8	3.66	1	13	13	13	2	20	20	20	-7	7
0205	8	N	3.8	3.66	2	8	20	14	2	10	13	11	3	-3
0213	8	N	3.8	4.27	4	7	20	17	1	15	15	15	2	-2
0217	8	N	3.8	4.27	3	20	20	20	1	16	16	16	4	-4
0214	8	N	6.2	3.66	4	19	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	4	3	20	16	1	8	8	8	8	-8
0202	8	N	6.2	4.27	2	10	20	15	2	20	20	20	-5	5
0206	8	N	6.2	4.27	2	10	20	15	2	20	20	20	-5	5
0209	8	Y	3.8	3.66	2	18	20	19	1	20	20	20	-1	1
0221	8	Y	3.8	4.27	4	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	4	16	20	19	1	20	20	20	-1	1
0210	8	Y	6.2	4.27	2	15	20	17	0	0	0	-	NC	NC
0215	11	N	3.8	3.66	4	8	20	17	1	20	20	20	-3	3
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0204	11	N	6.2	3.66	1	12	12	12	2	20	20	20	-8	8
0208	11	N	6.2	3.66	2	14	20	17	2	20	20	20	-3	3
0216	11	N	6.2	4.27	3	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0212	11	Y	6.2	3.66	2	15	20	17	2	20	20	20	-3	3
0224	11	Y	6.2	4.27	4	20	20	20	0	0	0	-	NC	NC
39% of the test sections in WNF performed better, 17% of the sections performed worse and 44% performed the same relative to those in the WF region; NC =could not be compared; No. = number of test sections;														

Table E.10 Impacts of DF and DNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on transverse cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Dry-freeze (DF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	DF	DNF
0201	8	N	3.8	3.66	1	20	20	20	1	5	5	5	15	-15
0205	8	N	3.8	3.66	1	20	20	20	1	10	10	10	10	-10
0213	8	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0217	8	N	3.8	4.27	1	20	20	20	1	17	17	17	3	-3
0214	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0202	8	N	6.2	4.27	1	20	20	20	1	7	7	7	13	-13
0206	8	N	6.2	4.27	1	20	20	20	1	13	13	13	7	-7
0209	8	Y	3.8	3.66	2	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	0	0	0	-	1	20	20	20	NC	NC
0210	8	Y	6.2	4.27	2	5	20	13	1	20	20	20	-7	7
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	1	20	20	20	1	17	17	17	3	-3
0207	11	N	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	16	16	16	1	20	20	20	-4	4
0220	11	N	6.2	4.27	1	20	20	20	0	0	0	-	NC	NC
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	1	20	20	20	1	20	20	20	0	0

9 % of the test sections in DNF performed better , 27% of the sections performed worse and 64% performed the same relative to those in the DF region; NC =could not be compared; No. = number of test sections;

Table E.11 Impacts of WF and DF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on transverse cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-freeze (WF)				Dry-freeze (DF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WF	DF
0201	8	N	3.8	3.66	1	13	13	13	1	20	20	20	-7	7
0205	8	N	3.8	3.66	2	8	20	14	1	20	20	20	-6	6
0213	8	N	3.8	4.27	4	7	20	17	1	20	20	20	-3	3
0217	8	N	3.8	4.27	3	20	20	20	1	20	20	20	0	0
0214	8	N	6.2	3.66	4	19	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	4	3	20	16	1	20	20	20	-4	4
0202	8	N	6.2	4.27	2	10	20	15	1	20	20	20	-5	5
0206	8	N	6.2	4.27	2	10	20	15	1	20	20	20	-5	5
0209	8	Y	3.8	3.66	2	18	20	19	2	20	20	20	-1	1
0221	8	Y	3.8	4.27	4	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	4	16	20	19	0	0	0	-	NC	NC
0210	8	Y	6.2	4.27	2	15	20	17	2	5	20	13	5	-5
0215	11	N	3.8	3.66	4	8	20	17	1	20	20	20	-3	3
0219	11	N	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0207	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	1	12	12	12	1	20	20	20	-8	8
0208	11	N	6.2	3.66	2	14	20	17	1	20	20	20	-3	3
0216	11	N	6.2	4.27	3	20	20	20	1	16	16	16	4	-4
0220	11	N	6.2	4.27	4	20	20	20	1	20	20	20	0	0
0223	11	Y	3.8	3.66	4	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	2	20	20	20	0	0
0212	11	Y	6.2	3.66	2	15	20	17	1	20	20	20	-3	3
0224	11	Y	6.2	4.27	4	20	20	20	1	20	20	20	0	0
48% of the test sections in DF performed better , 9% of the sections performed worse while 43% performed the same relative to those in the WF region; No. = number of test sections;														

Table E.12 Impacts of WNF and DNF climatic zones on pavement performance of LTPP SPS-2 test sections in terms of RSP based on transverse cracking

SHRP ID	PCC thickness	Drainage	Slab strength (MPa)	Lane width (m)	Wet-no-freeze (WNF)				Dry-no-freeze (DNF)				Difference in RSP (year)	
					No.	RSP (year)			No.	RSP (year)				
						Min	Max	Avg		Min	Max	Avg	WNF	DNF
0201	8	N	3.8	3.66	2	20	20	20	1	5	5	5	15	-15
0205	8	N	3.8	3.66	2	10	13	11	1	10	10	10	1	-1
0213	8	N	3.8	4.27	1	15	15	15	1	20	20	20	-5	5
0217	8	N	3.8	4.27	1	16	16	16	1	17	17	17	-2	2
0214	8	N	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0218	8	N	6.2	3.66	1	8	8	8	1	20	20	20	-12	12
0202	8	N	6.2	4.27	2	20	20	20	1	7	7	7	13	-13
0206	8	N	6.2	4.27	2	20	20	20	1	13	13	13	7	-7
0209	8	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0221	8	Y	3.8	4.27	1	20	20	20	1	20	20	20	0	0
0222	8	Y	6.2	3.66	1	20	20	20	1	20	20	20	0	0
0210	8	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
0215	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0219	11	N	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0203	11	N	3.8	4.27	2	20	20	20	1	17	17	17	3	-3
0207	11	N	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0204	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0208	11	N	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0216	11	N	6.2	4.27	1	20	20	20	1	20	20	20	0	0
0220	11	N	6.2	4.27	1	20	20	20	0	0	0	-	NC	NC
0223	11	Y	3.8	3.66	1	20	20	20	1	20	20	20	0	0
0211	11	Y	3.8	4.27	2	20	20	20	1	20	20	20	0	0
0212	11	Y	6.2	3.66	2	20	20	20	1	20	20	20	0	0
0224	11	Y	6.2	4.27	0	0	0	-	1	20	20	20	NC	NC
14% of the test sections in DNF performed better , 23% of the sections performed worse and 63% performed the same relative to those in the WNF region; NC =could not be compared														

APPENDIX F

Treatment Transition Matrices of Various Treatments Done on Flexible Pavement Segments in Various States

APPENDIX F

Treatment Transition Matrices of Various Treatments Done on Flexible Pavement Segments in Various States

The impacts and benefits of thin overlay, thick overlay, thin mill and fill, thick mill and fill, and chip seal on the 0.1 flexible pavement segments for each pavement condition and distress type in the states of Washington, Colorado, and Louisiana are presented in the treatment transition matrices (T^2M) are presented in Tables F.1 through F.60. The contents in each of the T^2M s are detailed below based on the alphabetically numbered columns within each matrix.

- Columns A through D of Table F.1 list the following BT information: the CS of the test section, the ranges of the RFP or RSP, and the number and the percentages of the LTPP test sections in each BT CS.
- Columns E through I list the following AT information: the CS of the test section, the ranges of the RFP or RSP, and the number of the LTPP test sections transitioned from the given BT CS based on RFP or RSP to each AT CS based on RFP or RSP and the total number of LTPP test sections transitioned to each AT CS.
- Columns J through L list the following pavement treatment benefits: the average FCROP or SCROP, CFP or CSP, and AT RFP or AT RSP of all LTPP test sections transitioned from a given BT CS to all AT CSs, and the overall average FCROP or SCROP, CFP or CSP, and AT RFP or AT RSP.

Table F.1 Functional treatment transition matrix for thin overlay (IRI, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin overlay based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	83	24	**4**	2	4	11	62	17	16	17
B	2	2 to < 4	42	12	0	**0**	0	0	42	18	16	20
C	3	4 to < 8	88	25	0	0	**1**	3	84	15	12	20
D	4	8 to < 13	36	10	0	0	0	**2**	34	12	7	20
E	5	≥ 13	100	29	0	0	1	13	**86**	7	-1	19
F	Total		349	100	4	2	6	29	308	13	9	19

Table F.2 Functional/structural treatment transition matrix for thin overlay (rut depth, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin overlay based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	116	16	**0**	0	1	3	112	19	19	20
B	2	2 to < 4	39	6	0	**0**	0	0	39	19	16	20
C	3	4 to < 8	79	11	0	0	**0**	1	78	17	12	20
D	4	8 to < 13	68	10	0	0	0	**0**	68	17	7	20
E	5	≥ 13	407	57	0	0	1	8	**398**	12	0	20
F	Total		709	100	0	0	2	12	695	15	6	20

Table F.3 Structural treatment transition matrix for thin overlay (alligator cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	596	34	**0**	0	27	64	505	18	18	19
B	2	2 to < 4	57	3	0	**0**	0	5	52	18	15	19
C	3	4 to < 8	108	6	0	0	**21**	23	64	13	8	16
D	4	8 to < 13	23	1	0	0	0	**1**	22	19	7	20
E	5	≥ 13	962	55	0	4	110	97	**751**	10	-2	18
F	Total		1746	100	0	4	158	190	1394	13	6	18

Table F.4 Structural treatment transition matrix for thin overlay (longitudinal cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	176	18	**0**	6	6	36	128	16	17	18
B	2	2 to < 4	72	7	0	**0**	3	20	49	15	14	18
C	3	4 to < 8	90	9	0	0	**12**	21	57	14	9	17
D	4	8 to < 13	52	5	0	0	4	**12**	36	12	4	17
E	5	≥ 13	610	61	0	0	12	110	**488**	12	-1	19
F	Total		1000	100	0	6	37	199	758	13	4	18

Table F.5 Structural treatment transition matrix for thin overlay (transverse cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	15	1	**0**	0	0	0	15	20	19	20
B	2	2 to < 4	93	6	0	**0**	0	0	93	19	16	20
C	3	4 to < 8	83	5	0	0	**0**	9	74	18	11	19
D	4	8 to < 13	87	6	0	0	0	**6**	81	15	7	20
E	5	≥ 13	1260	82	0	0	15	87	**1158**	11	-1	19
F	Total		1538	100	0	0	15	102	1421	12	2	19

Table F.6 Functional treatment transition matrix for thick overlay (IRI, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thick overlay based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	1	10	0	**0**	0	0	1	20	16	20
C	3	4 to < 8	0	0	0	0	**0**	0	0			
D	4	8 to < 13	3	30	0	0	0	**0**	3	9	7	20
E	5	≥ 13	6	60	0	0	0	0	**6**	9	0	20
F	Total		10	100	0	0	0	0	10	10	4	20

Table F.7 Functional/structural treatment transition matrix for thick overlay (rut depth, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thick overlay based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	23	19	**0**	0	0	1	22	18	19	20
B	2	2 to < 4	18	15	0	**0**	0	1	17	16	16	20
C	3	4 to < 8	20	16	0	0	**0**	1	19	18	12	20
D	4	8 to < 13	9	7	0	0	0	**0**	9	16	7	20
E	5	≥ 13	52	43	0	0	0	0	**52**	13	0	20
F	Total		122	100	0	0	0	3	119	15	8	20

Table F.8 Structural treatment transition matrix for thick overlay (alligator cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	135	33	**0**	0	24	39	72	15	15	16
B	2	2 to < 4	19	5	0	**0**	0	7	12	16	13	17
C	3	4 to < 8	3	1	0	0	**0**	0	3	20	12	20
D	4	8 to < 13	1	0	0	0	0	**0**	1	20	7	20
E	5	≥ 13	245	61	0	0	1	53	**191**	13	-2	18
F	Total		403	100	0	0	25	99	279	14	5	18

Table F.9 Structural treatment transition matrix for thick overlay (longitudinal cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	18	6	**0**	0	0	0	18	18	19	20
B	2	2 to < 4	5	2	0	**0**	0	2	3	15	13	17
C	3	4 to < 8	6	2	0	0	**0**	0	6	15	12	20
D	4	8 to < 13	0	0	0	0	0	**0**	0			
E	5	≥ 13	281	91	0	0	0	49	**232**	13	-1	19
F	Total		310	100	0	0	0	51	259	14	0	19

Table F.10 Structural treatment transition matrix for thick overlay (transverse cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	28	13	0	**0**	0	1	27	19	16	20
C	3	4 to < 8	6	3	0	0	**0**	0	6	16	12	20
D	4	8 to < 13	0	0	0	0	0	**0**	0			
E	5	≥ 13	186	85	0	0	0	0	**186**	16	0	20
F	Total		220	100	0	0	0	1	219	17	2	20

Table F.11 Functional treatment transition matrix for thin mill and fill (IRI, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin mill and fill based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	16	13	**0**	1	1	3	11	15	16	17
B	2	2 to < 4	15	12	0	**0**	1	0	14	18	15	19
C	3	4 to < 8	25	20	0	0	**0**	1	24	17	12	20
D	4	8 to < 13	17	14	0	0	0	**1**	16	13	7	20
E	5	≥ 13	50	41	0	0	0	2	**48**	12	0	20
F	Total		123	100	0	1	2	7	113	14	7	19

Table F.12 Functional/structural treatment transition matrix for thin mill and fill (rut depth, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin mill and fill based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	222	32	**0**	0	3	22	197	19	18	19
B	2	2 to < 4	35	5	0	**0**	1	0	34	18	16	20
C	3	4 to < 8	60	9	0	1	**3**	4	52	16	11	19
D	4	8 to < 13	45	6	0	0	3	**5**	37	14	5	18
E	5	≥ 13	339	48	0	1	7	13	**318**	13	-1	19
F	Total		701	100	0	2	17	44	638	16	8	19

Table F.13 Structural treatment transition matrix for thin mill and fill (alligator cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	147	17	**1**	0	12	7	127	18	18	19
B	2	2 to < 4	24	3	0	**0**	3	0	21	17	15	19
C	3	4 to < 8	14	2	0	0	**1**	0	13	18	11	19
D	4	8 to < 13	89	10	0	0	0	**0**	89	4	7	20
E	5	≥ 13	612	69	0	0	77	100	**435**	9	-3	17
F	Total		886	100	1	0	93	107	685	10	2	18

Table F.14 Structural treatment transition matrix for thin mill and fill (longitudinal cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	29	8	**0**	0	0	4	25	16	18	19
B	2	2 to < 4	28	8	0	**1**	3	2	22	14	14	18
C	3	4 to < 8	51	14	0	0	**1**	13	37	15	10	18
D	4	8 to < 13	34	10	0	0	2	**8**	24	14	5	18
E	5	≥ 13	215	60	0	0	5	36	**174**	6	-1	19
F	Total		357	100	0	1	11	63	282	9	4	18

Table F.15 Structural treatment transition matrix for thin mill and fill (transverse cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	4	1	**0**	0	0	0	4	16	19	20
B	2	2 to < 4	22	3	0	**0**	0	0	22	16	16	20
C	3	4 to < 8	44	7	0	0	**2**	3	39	16	11	19
D	4	8 to < 13	104	16	0	0	2	**8**	94	8	6	19
E	5	≥ 13	459	73	0	0	10	25	**424**	10	-1	19
F	Total		633	100	0	0	14	36	583	11	2	19

Table F.16 Functional treatment transition matrix for chip seal (IRI, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after chip seal based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	20	38	**12**	1	4	3	0	6	3	4
B	2	2 to < 4	5	10	0	**0**	2	1	2	11	10	14
C	3	4 to < 8	8	15	1	0	**0**	1	6	0	9	17
D	4	8 to < 13	8	15	0	1	0	**0**	7	2	5	18
E	5	≥ 13	11	21	0	1	1	1	**8**	-7	-3	17
F	Total		52	100	13	3	7	6	23	2	4	12

Table F.17 Functional/structural treatment transition matrix for chip seal (rut depth, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after chip seal based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	0	0	0	**0**	0	0	0			
C	3	4 to < 8	1	3	0	0	**0**	0	1	20	12	20
D	4	8 to < 13	2	5	0	0	0	**0**	2	20	7	20
E	5	≥ 13	35	92	0	0	0	0	**35**	9	0	20
F	Total		38	100	0	0	0	0	38	9	1	20

Table F.18 Structural treatment transition matrix for chip seal (transverse cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	10	6	**0**	0	0	0	10	18	19	20
B	2	2 to < 4	6	4	0	**0**	2	1	3	12	11	15
C	3	4 to < 8	9	6	0	0	**0**	0	9	17	12	20
D	4	8 to < 13	5	3	0	0	1	**0**	4	10	5	18
E	5	≥ 13	126	81	0	0	1	4	**121**	5	0	20
F	Total		156	100	0	0	4	5	147	7	2	19

Table F.19 Structural treatment transition matrix for chip seal (longitudinal cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	8	7	**0**	0	0	2	6	14	17	18
B	2	2 to < 4	11	10	0	**0**	1	1	9	16	14	18
C	3	4 to < 8	17	15	0	0	**0**	4	13	16	10	18
D	4	8 to < 13	9	8	0	0	0	**2**	7	13	5	18
E	5	≥ 13	66	59	0	0	1	4	**61**	7	-1	19
F	Total		111	100	0	0	2	13	96	10	4	19

Table F.20 Structural treatment transition matrix for chip seal (transverse cracking, number of 0.1-mile pavement segments in the State of Washington)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	1	1	0	**0**	0	0	1	10	16	20
C	3	4 to < 8	0	0	0	0	**0**	0	0			
D	4	8 to < 13	3	2	0	0	0	**0**	3	20	7	20
E	5	≥ 13	190	98	0	0	0	0	**190**	4	0	20
F	Total		194	100	0	0	0	0	194	5	0	20

Table F.21 Functional treatment transition matrix for thin overlay (IRI, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin overlay based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	16	17	**5**	2	1	2	6	10	9	10
B	2	2 to < 4	21	22	5	**7**	5	0	4	4	3	7
C	3	4 to < 8	17	18	3	6	**4**	0	4	3	0	8
D	4	8 to < 13	13	14	0	4	2	**2**	5	4	-1	12
E	5	≥ 13	27	29	1	2	1	3	**20**	-3	-3	17
F	Total		94	100	14	21	13	7	39	3	1	11

Table F.22 Functional/structural treatment transition matrix for thin overlay (rut depth, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin overlay based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	1	1	0	**1**	0	0	0	3	0	4
C	3	4 to < 8	7	6	0	3	**1**	0	3	6	3	11
D	4	8 to < 13	15	12	0	5	3	**1**	6	6	-1	12
E	5	≥ 13	103	82	0	20	13	6	**64**	7	-5	15
F	Total		126	100	0	29	17	7	73	7	-4	14

Table F.23 Structural treatment transition matrix for thin overlay (alligator cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	20	16	**0**	13	7	0	0	3	4	5
B	2	2 to < 4	10	8	0	**4**	6	0	0	2	2	6
C	3	4 to < 8	8	6	0	0	**6**	2	0	3	1	9
D	4	8 to < 13	5	4	0	1	3	**1**	0	0	-5	8
E	5	≥ 13	85	66	0	2	67	6	**10**	-1	-10	10
F	Total		128	100	0	20	89	9	10	0	-6	9

Table F.24 Structural treatment transition matrix for thin overlay (longitudinal cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	24	19	**0**	3	18	2	1	4	7	8
B	2	2 to < 4	15	12	0	**0**	10	4	1	4	6	10
C	3	4 to < 8	16	12	0	0	**10**	3	3	3	3	11
D	4	8 to < 13	13	10	0	0	8	**2**	3	4	-1	12
E	5	≥ 13	61	47	0	0	35	16	**10**	-3	-9	11
F	Total		129	100	0	3	81	27	18	1	-2	11

Table F.25 Structural treatment transition matrix for thin overlay (transverse cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	26	37	**0**	10	7	7	2	7	8	9
B	2	2 to < 4	9	13	0	**0**	4	0	5	9	11	15
C	3	4 to < 8	6	9	0	0	**1**	0	5	9	10	18
D	4	8 to < 13	11	16	0	1	3	**0**	7	6	2	15
E	5	≥ 13	18	26	1	2	4	3	**8**	-5	-7	13
F	Total		70	100	1	13	19	10	27	4	4	13

Table F.26 Functional treatment transition matrix for thin mill and fill (IRI, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin mill and fill based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	19	68	**0**	0	7	6	6	14	12	13
B	2	2 to < 4	0	0	0	**0**	0	0	0			
C	3	4 to < 8	2	7	0	1	**0**	0	1	11	4	12
D	4	8 to < 13	1	4	0	0	0	**0**	1	8	7	20
E	5	≥ 13	6	21	0	0	1	1	**4**	-3	-3	17
F	Total		28	100	0	1	8	7	12	10	8	14

Table F.27 Functional/structural treatment transition matrix for thin mill and fill (rut depth, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin mill and fill based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	19	26	**0**	0	0	0	19	20	19	20
B	2	2 to < 4	3	4	0	**0**	0	0	3	20	16	20
C	3	4 to < 8	2	3	0	0	**0**	0	2	19	12	20
D	4	8 to < 13	6	8	0	0	0	**0**	6	17	7	20
E	5	≥ 13	44	59	0	0	1	1	**42**	11	0	20
F	Total		74	100	0	0	1	1	72	14	6	20

Table F.28 Structural treatment transition matrix for thin mill and fill (alligator cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	15	31	**0**	0	7	1	7	12	13	14
B	2	2 to < 4	12	24	0	**0**	7	2	3	8	8	12
C	3	4 to < 8	6	12	0	0	**6**	0	0	4	0	8
D	4	8 to < 13	3	6	0	0	3	**0**	0	4	-5	8
E	5	≥ 13	13	27	0	1	9	2	**1**	4	-11	9
F	Total		49	100	0	1	32	5	11	7	3	11

Table F.29 Structural treatment transition matrix for thin mill and fill (longitudinal cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	2	5	**0**	0	1	1	0	7	10	11
B	2	2 to < 4	10	26	0	**2**	7	0	1	4	4	8
C	3	4 to < 8	9	24	0	0	**9**	0	0	3	0	8
D	4	8 to < 13	5	13	0	0	5	**0**	0	3	-5	8
E	5	≥ 13	12	32	0	0	10	1	**1**	3	-11	9
F	Total		38	100	0	2	32	2	2	4	-2	9

Table F.30 Structural treatment transition matrix for thin mill and fill (transverse cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	4	17	**0**	0	3	1	0	7	8	9
B	2	2 to < 4	2	8	0	**1**	0	0	1	10	8	12
C	3	4 to < 8	5	21	0	2	**3**	0	0	1	-2	6
D	4	8 to < 13	4	17	0	0	3	**1**	0	-3	-4	9
E	5	≥ 13	9	38	0	3	5	1	**0**	-1	-13	7
F	Total		24	100	0	6	14	3	1	1	-4	8

Table F.31 Functional treatment transition matrix for chip seal (IRI, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after chip seal based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	4	8	**1**	2	1	0	0	3	3	4
B	2	2 to < 4	9	18	0	**1**	3	4	1	4	7	11
C	3	4 to < 8	7	14	0	0	**1**	0	6	1	10	18
D	4	8 to < 13	14	28	0	0	1	**0**	13	1	6	19
E	5	≥ 13	16	32	0	1	1	2	**12**	-5	-3	17
F	Total		50	100	1	4	7	6	32	0	4	16

Table F.32 Functional/structural treatment transition matrix for chip seal (rut depth, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after chip seal based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	0	0	**0**	0	0	0	0			
B	2	2 to < 4	0	0	0	**0**	0	0	0			
C	3	4 to < 8	2	17	0	0	**0**	0	2	1	12	20
D	4	8 to < 13	3	25	0	0	0	**0**	3	0	7	20
E	5	≥ 13	7	58	0	0	0	1	**6**	0	-1	19
F	Total		12	100	0	0	0	1	11	0	3	19

Table F.33 Structural treatment transition matrix for chip seal (alligator cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	24	56	**1**	2	18	3	0	5	7	8
B	2	2 to < 4	7	16	0	**0**	2	2	3	5	11	15
C	3	4 to < 8	9	21	0	0	**3**	4	2	5	5	13
D	4	8 to < 13	2	5	0	0	0	**1**	1	2	4	17
E	5	≥ 13	1	2	0	0	1	0	**0**	2	-12	8
F	Total		43	100	1	2	24	10	6	5	7	10

Table F.34 Structural treatment transition matrix for chip seal (longitudinal cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	16	46	**0**	0	8	3	5	7	12	13
B	2	2 to < 4	15	43	0	**0**	5	5	5	4	10	14
C	3	4 to < 8	4	11	0	0	**2**	2	0	4	3	11
D	4	8 to < 13	0	0	0	0	0	**0**	0			
E	5	≥ 13	0	0	0	0	0	0	**0**			
F	Total		35	100	0	0	15	10	10	5	10	13

Table F.35 Structural treatment transition matrix for chip seal (transverse cracking, number of 0.1-mile pavement segments in the State of Colorado)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	31	60	**1**	16	13	1	0	3	5	6
B	2	2 to < 4	12	23	0	**2**	9	1	0	2	4	8
C	3	4 to < 8	6	12	0	1	**4**	1	0	3	0	8
D	4	8 to < 13	2	4	0	0	1	**1**	0	0	-3	11
E	5	≥ 13	1	2	0	1	0	0	**0**	3	-16	4
F	Total		52	100	1	20	27	4	0	3	3	7

Table F.36 Functional treatment transition matrix for thin overlay (IRI, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin overlay based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	197	18	**122**	17	25	14	19	6	4	5
B	2	2 to < 4	54	5	5	**10**	12	10	17	4	7	11
C	3	4 to < 8	112	10	12	12	**15**	31	42	4	5	13
D	4	8 to < 13	598	55	8	34	144	**166**	246	-4	1	14
E	5	≥ 13	128	12	0	0	13	31	**84**	-5	-3	17
F	Total		1089	100	147	73	209	252	408	-1	2	12

Table F.37 Functional/structural treatment transition matrix for thin overlay (rut depth, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin overlay based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	39	17	**0**	0	4	4	31	18	17	18
B	2	2 to < 4	4	2	0	**0**	0	0	4	20	16	20
C	3	4 to < 8	14	6	0	0	**0**	0	14	20	12	20
D	4	8 to < 13	6	3	0	0	0	**0**	6	20	7	20
E	5	≥ 13	161	72	0	0	0	2	**159**	18	0	20
F	Total		224	100	0	0	4	6	214	18	4	20

Table F.38 Structural treatment transition matrix for thin overlay (alligator cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	163	81	**1**	14	88	15	45	10	10	11
B	2	2 to < 4	12	6	0	**1**	7	1	3	8	7	11
C	3	4 to < 8	11	5	0	2	**6**	1	2	5	2	10
D	4	8 to < 13	10	5	0	0	7	**1**	2	6	-2	11
E	5	≥ 13	6	3	0	1	3	0	**2**	5	-9	11
F	Total		202	100	1	18	111	18	54	10	9	11

Table F.39 Structural treatment transition matrix for thin overlay (longitudinal cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	18	25	**0**	0	1	9	8	12	15	16
B	2	2 to < 4	10	14	0	**0**	0	3	7	14	14	18
C	3	4 to < 8	12	17	0	0	**1**	4	7	11	9	17
D	4	8 to < 13	17	24	0	0	2	**6**	9	8	3	16
E	5	≥ 13	14	20	0	0	0	3	**11**	9	-2	19
F	Total		71	100	0	0	4	25	42	11	8	17

Table F.40 Structural treatment transition matrix for thin overlay (transverse cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin overlay based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	67	50	**1**	4	50	7	5	7	8	9
B	2	2 to < 4	12	9	0	**0**	10	1	1	6	5	9
C	3	4 to < 8	15	11	0	0	**6**	1	8	6	7	15
D	4	8 to < 13	3	2	0	0	1	**0**	2	6	3	16
E	5	≥ 13	37	28	0	0	19	6	**12**	6	-7	13
F	Total		134	100	1	4	86	15	28	7	3	11

Table F.41 Functional treatment transition matrix for thick overlay (IRI, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thick overlay based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	963	68	**3**	4	53	96	807	18	18	19
B	2	2 to < 4	57	4	0	**0**	1	7	49	17	15	19
C	3	4 to < 8	82	6	0	0	**4**	9	69	16	11	19
D	4	8 to < 13	263	19	0	0	5	**18**	240	16	6	19
E	5	≥ 13	51	4	0	0	3	1	**47**	17	-1	19
F	Total		1416	100	3	4	66	131	1212	18	14	19

Table F.42 Functional/structural treatment transition matrix for thick overlay (rut depth, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thick overlay based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	309	25	**0**	1	0	22	286	10	18	19
B	2	2 to < 4	39	3	0	**0**	0	2	37	10	16	20
C	3	4 to < 8	58	5	0	0	**0**	0	58	10	12	20
D	4	8 to < 13	53	4	0	0	0	**3**	50	10	7	20
E	5	≥ 13	783	63	0	1	0	24	**758**	9	0	20
F	Total		1242	100	0	2	0	51	1189	10	6	20

Table F.43 Structural treatment transition matrix for thick overlay (alligator cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	957	80	**6**	51	220	140	540	15	14	15
B	2	2 to < 4	64	5	0	**6**	7	6	45	16	13	17
C	3	4 to < 8	61	5	2	3	**4**	10	42	15	9	17
D	4	8 to < 13	90	8	1	10	16	**7**	56	13	2	15
E	5	≥ 13	27	2	1	0	6	9	**11**	6	-6	14
F	Total		1199	100	10	70	253	172	694	15	13	15

Table F.44 Structural treatment transition matrix for thick overlay (longitudinal cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	102	17	**0**	0	23	32	47	13	14	15
B	2	2 to < 4	74	12	0	**0**	6	22	46	13	13	17
C	3	4 to < 8	108	18	0	0	**4**	30	74	13	10	18
D	4	8 to < 13	205	34	0	0	24	**34**	147	12	4	17
E	5	≥ 13	106	18	0	0	2	23	**81**	5	-2	18
F	Total		595	100	0	0	59	141	395	11	7	17

Table F.45 Structural treatment transition matrix for thick overlay (transverse cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick overlay based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	511	52	**0**	2	175	173	161	12	12	13
B	2	2 to < 4	103	10	0	**0**	22	42	39	11	11	15
C	3	4 to < 8	127	13	0	1	**47**	32	47	9	6	14
D	4	8 to < 13	134	14	0	1	42	**45**	46	6	1	14
E	5	≥ 13	109	11	0	0	21	34	**54**	2	-4	16
F	Total		984	100	0	4	307	326	347	10	8	14

Table F.46 Functional treatment transition matrix for thin mill and fill (IRI, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thin mill and fill based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	78	48	**0**	1	3	24	50	17	16	17
B	2	2 to < 4	10	6	0	**0**	0	2	8	15	15	19
C	3	4 to < 8	17	10	0	0	**2**	2	13	13	10	18
D	4	8 to < 13	35	21	0	0	1	**3**	31	14	6	19
E	5	≥ 13	23	14	0	0	0	0	**23**	10	0	20
F	Total		163	100	0	1	6	31	125	15	11	18

Table F.47 Functional/structural treatment transition matrix for thin mill and fill (rut depth, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thin mill and fill based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	110	58	**0**	0	1	6	103	20	19	20
B	2	2 to < 4	3	2	0	**0**	0	0	3	18	16	20
C	3	4 to < 8	8	4	0	0	**0**	0	8	18	12	20
D	4	8 to < 13	70	37	0	0	0	**2**	68	17	7	20
E	5	≥ 13	0	0	0	0	0	0	**0**			
F	Total		191	100	0	0	1	8	182	19	14	20

Table F.48 Structural treatment transition matrix for thin mill and fill (alligator cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	68	47	**0**	1	2	2	63	19	18	19
B	2	2 to < 4	3	2	0	**0**	1	0	2	15	12	16
C	3	4 to < 8	9	6	0	0	**1**	0	8	18	11	19
D	4	8 to < 13	23	16	0	0	2	**0**	21	15	6	19
E	5	≥ 13	43	29	0	0	2	29	**12**	2	-5	15
F	Total		146	100	0	1	8	31	106	13	9	18

Table F.49 Structural treatment transition matrix for thin mill and fill (longitudinal cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	34	43	**0**	0	2	3	29	18	18	19
B	2	2 to < 4	10	13	0	**0**	0	0	10	17	16	20
C	3	4 to < 8	5	6	0	0	**0**	0	5	20	12	20
D	4	8 to < 13	20	25	0	0	5	**4**	11	12	3	16
E	5	≥ 13	11	14	0	0	0	0	**11**	-14	0	20
F	Total		80	100	0	0	7	7	66	12	11	18

Table F.50 Structural treatment transition matrix for thin mill and fill (transverse cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thin mill and fill based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	86	64	**0**	1	41	23	21	11	11	12
B	2	2 to < 4	8	6	0	**0**	0	0	8	19	16	20
C	3	4 to < 8	7	5	0	0	**0**	0	7	20	12	20
D	4	8 to < 13	3	2	0	0	0	**0**	3	20	7	20
E	5	≥ 13	31	23	0	1	2	0	**28**	13	-1	19
F	Total		135	100	0	2	43	23	67	12	9	15

Table F.51 Functional treatment transition matrix for thick mill and fill (IRI, number of 0.1-mile pavement segments in the State of Louisiana)

ow designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after thick mill and fill based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	419	57	**1**	3	39	105	271	17	16	17
B	2	2 to < 4	35	5	0	**0**	2	5	28	16	14	18
C	3	4 to < 8	47	6	0	0	**2**	6	39	15	11	19
D	4	8 to < 13	227	31	0	1	11	**29**	186	14	5	18
E	5	≥ 13	7	1	0	0	0	0	**7**	17	0	20
F	Total		735	100	1	4	54	145	531	16	12	18

Table F.52 Functional/structural treatment transition matrix for thick mill and fill (rut depth, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after thick mill and fill based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	267	28	**0**	1	31	63	172	17	16	17
B	2	2 to < 4	26	3	0	**0**	0	2	24	18	15	19
C	3	4 to < 8	45	5	0	0	**1**	5	39	17	11	19
D	4	8 to < 13	579	61	0	0	13	**95**	471	13	6	19
E	5	≥ 13	40	4	0	0	0	0	**40**	15	0	20
F	Total		957	100	0	1	45	165	746	14	9	18

Table F.53 Structural treatment transition matrix for thick mill and fill (alligator cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick mill and fill based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	511	84	3	4	77	47	380	17	16	17
B	2	2 to < 4	22	4	0	0	3	4	15	16	13	17
C	3	4 to < 8	20	3	0	0	2	0	18	17	11	19
D	4	8 to < 13	52	9	0	0	18	7	27	11	2	15
E	5	≥ 13	0	0	0	0	0	0	0			
F	Total		605	100	3	4	100	58	440	17	15	17

Table F.54 Structural treatment transition matrix for thick mill and fill (longitudinal cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick mill and fill based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	45	16	**0**	0	17	13	15	12	12	13
B	2	2 to < 4	26	9	0	**0**	5	8	13	14	12	16
C	3	4 to < 8	45	16	0	0	**6**	5	34	14	10	18
D	4	8 to < 13	170	59	0	1	29	**20**	120	13	4	17
E	5	≥ 13	0	0	0	0	0	0	**0**			
F	Total		286	100	0	1	57	46	182	13	7	16

Table F.55 Structural treatment transition matrix for thick mill and fill (transverse cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after thick mill and fill based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	258	65	**0**	1	55	29	173	17	16	17
B	2	2 to < 4	26	7	0	**0**	9	6	11	11	10	14
C	3	4 to < 8	31	8	0	0	**9**	7	15	12	7	15
D	4	8 to < 13	79	20	0	0	12	**18**	49	12	4	17
E	5	≥ 13	2	1	0	0	0	0	**2**	20	0	20
F	Total		396	100	0	1	85	60	250	15	12	16

Table F.56 Functional treatment transition matrix for chip seal (IRI, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional period (RFP) before and after chip seal based on IRI											
	Before treatment (BT)				After treatment (AT)							
	RFP condition state and the number and percent of pavement sections in each condition state				RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RFP condition state to the indicated AT RFP condition states					Weighted average functional condition re-occurrence period (FCROP), change in functional period (CFP), and AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	FCROP	CFP	AT RFP
	RFP condition code	RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	197	18	**122**	17	25	14	19	6	4	5
B	2	2 to < 4	54	5	5	**10**	12	10	17	4	7	11
C	3	4 to < 8	112	10	12	12	**15**	31	42	4	5	13
D	4	8 to < 13	598	55	8	34	144	**166**	246	-4	1	14
E	5	≥ 13	128	12	0	0	13	31	**84**	-5	-3	17
F	Total		1089	100	147	73	209	252	408	-1	2	12

Table F.57 Functional/structural treatment transition matrix for chip seal (rut depth, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining functional/structural period (RFP/RSP) before and after chip seal based on rut depth											
	Before treatment (BT)				After treatment (AT)							
	RSP/RFP condition state and the number and percent of pavement sections in each condition state				RSP/ RFP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP/ RFP condition state to the indicated AT RSP/ RFP condition states					Weighted average structural or functional condition re-occurrence period (SCROP/FCROP), change in structural or functional period(CSP/CFP), and AT RSP or AT RFP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP/ FCROP	CSP/ CFP	AT RFP/ RSP
	RSP/RFP condition code	RSP/RFP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	20	3	**4**	3	0	0	13	14	13	14
B	2	2 to < 4	15	3	0	**0**	1	1	13	17	15	19
C	3	4 to < 8	17	3	1	0	**1**	1	14	14	10	18
D	4	8 to < 13	393	68	2	0	1	**6**	384	8	7	20
E	5	≥ 13	129	22	0	1	2	0	**126**	6	0	20
F	Total		574	100	7	4	5	8	550	8	6	19

Table F.58 Structural treatment transition matrix for chip seal (alligator cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on alligator cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated AT RSP condition states					Weighted average structural re-occurrence period, change in structural period, and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	1302	81	**130**	159	562	199	252	10	9	10
B	2	2 to < 4	69	4	7	**14**	12	13	23	7	7	11
C	3	4 to < 8	67	4	3	5	**17**	10	32	8	6	14
D	4	8 to < 13	119	7	17	5	39	**17**	41	-1	-1	12
E	5	≥ 13	48	3	0	0	5	11	**32**	-3	-3	17
F	Total		1605	100	157	183	635	250	380	9	8	10

Table F.59 Structural treatment transition matrix for chip seal (longitudinal cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on longitudinal cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	223	29	**0**	0	12	67	144	15	16	17
B	2	2 to < 4	131	17	0	**0**	19	47	65	12	12	16
C	3	4 to < 8	133	17	0	0	**13**	32	88	13	9	17
D	4	8 to < 13	222	29	0	0	40	**49**	133	6	3	16
E	5	≥ 13	63	8	0	0	0	7	**56**	7	-1	19
F	Total		772	100	0	0	84	202	486	11	9	17

Table F.60 Structural treatment transition matrix for chip seal (transverse cracking, number of 0.1-mile pavement segments in the State of Louisiana)

Row designation	Column designation											
	A	B	C	D	E	F	G	H	I	J	K	L
	Remaining structural period (RSP) before and after chip seal based on transverse cracking											
	Before treatment (BT)				After treatment (AT)							
	RSP condition state and the number and percent of pavement sections in each condition state				RSP condition states and range in year and the number of the 0.1-mile pavement segments transferred from each BT RSP condition state to the indicated RSP condition states					Weighted average functional condition re-occurrence period (SCROP), change in functional period (CSP), and AT RSP of the treatment (year)		
	Condition state		0.1-mile pavement segments		1	2	3	4	5	SCROP	CSP	AT RSP
	RSP condition code	RSP ranges (years)	Number	Percent	< 2	2 to < 4	4 to < 8	8 to < 13	≥ 13			
A	1	< 2	512	63	**7**	23	228	132	122	11	11	12
B	2	2 to < 4	76	9	0	**1**	14	25	36	10	11	15
C	3	4 to < 8	70	9	0	0	**26**	16	28	7	6	14
D	4	8 to < 13	119	15	0	0	28	**28**	63	4	3	16
E	5	≥ 13	42	5	0	0	2	8	**32**	4	-2	18
F	Total		819	100	7	24	298	209	281	9	9	13

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