ULTRA-THIN PORTLAND CEMENT CONCRETE OVERLAY EXTENDED EVALUATION

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16. Abstract

In this day of the mature highway systems, a new set of problems is facing the highway engineer. The existing infrastructure has aged to or past the design life of the original pavement design. In many cases, increased commercial traffic is creating the need for additional load carrying capacity, causing state highway engineers to consider new alternatives for rehabilitation of existing surfaces. Alternative surface materials, thicknesses, and methods of installation must be identified to meet the needs of individual pavements and budgets. With overlays being one of the most frequently used rehabilitation alternatives, it is important to learn more about the limitations and potential performance of thin bonded portland cement overlays and subsequent rehabilitation.

The Iowa ultra-thin project demonstrated the application of thin portland cement concrete overlays as a rehabilitation technique. It combined the variables of base preparation, overlay thickness, slab size, and fiber enhancement into a series of test sections over a 7.2-mile length. This report identifies the performance of the overlays in terms of deflection reduction, reduced cracking, and improved bonding between the portland cement concrete (PCC) and asphalt cement concrete (ACC) base layers. The original research project was designed to evaluate the variables over a 5-year period of time. A second project provided the opportunity to test overlay rehabilitation techniques and continue measurement of the original overlay performance for 5 additional years.

All performance indicators identified exceptional performance over the 10-year evaluation period for each of the variable combinations considered. The report summarizes the research methods, results, and identifies future research ideas to aid the pavement overlay designer in the successful implementation of ultra-thin portland cement concrete overlays as an alternative pavement rehabilitation technique.

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This project is the combined effort of Iowa State University, the Iowa Department of Transportation, Iowa Concrete Paving Association, and Federal Highway Administration. The researchers would like to acknowledge the Iowa Department of Transportation Office of Materials Special Investigations Unit for contributing their time and effort in collecting and analyzing specialized field data.

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ABSTRACT

In this day of the mature highway systems, a new set of problems is facing the highway engineer. The existing infrastructure has aged to or past the design life of the original pavement design. In many cases, increased commercial traffic is creating the need for additional load carrying capacity, causing state highway engineers to consider new alternatives for rehabilitation of existing surfaces. Alternative surface materials, thicknesses, and methods of installation must be identified to meet the needs of individual pavements and budgets. With overlays being one of the most frequently used rehabilitation alternatives, it is important to learn more about the limitations and potential performance of thin bonded Portland cement overlays and subsequent rehabilitation.

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INTRODUCTION

Background

Resurfacing deteriorated pavements with Portland cement concrete (PCC) whitetopping has been regarded as an effective method of pavement rehabilitation for many years. It is shown to provide improved structural capacity, increased life, and reduced maintenance at a lower cost in comparison to asphalt reconstruction. In addition, whitetopping has the potential to improve highway safety through the elimination of rutting and other problems normally associated with asphalt. Whitetopping also has environmental benefits and reflects light well.

In recent years, ultra-thin whitetopping (UTW) has emerged as valuable alternative to the traditional Portland cement concrete overlay process. UTW is a process that involves placing a thin layer (2 to 4 inches) of PCC over an existing asphalt cement concrete (ACC) surface. In addition to reduced concrete thickness, ultra-thin whitetopping can be distinguished from normal whitetopping through the existence of interface bonding between PCC and ACC layers and closer-than-normal joint spacing. Since the first modern ultra-thin whitetopping project was constructed in Louisville, Kentucky, in 1991, many rehabilitation projects across the United States have implemented UTW with encouraging results.

The Engineering Research Institute of Iowa State University, along with the Iowa Department of Transportation (Iowa DOT) and the Federal Highway Administration (FHWA), has been conducting ongoing research on the performance of thin concrete overlays on highway pavements.

This project involved the continuation of a study of 41 test sections constructed on a 7.2-mile section of Iowa Highway 21 near Bell Plaine, Iowa. The original ultra-thin project, Iowa Highway Research Board project number HR-559, was conducted from July 1994 through July 1999 in what was the construction and evaluation of the largest ultra-thin whitetopping project in the United States. Variables included the depth of concrete overlay, transverse joint spacing, existing surface preparation, use of fiber reinforcement, and joint preparation/sealing. Several sections of 2-inch nominal depth concrete were placed as part of this project to extend the knowledge on how shallow depth could be used and attain satisfactory performance over the five-year research period.

With the success of the HR-559 project and the minimal loss of slabs and/or minimal slab cracking throughout the evaluation, this report is the culmination of an extended phase of research from August 1999 through August 2004. The five-year extension of research at this location provided the Iowa Department of Transportation and Iowa State University researchers with a unique opportunity to better understand the capabilities of thin concrete overlays and rehabilitation techniques for patching or replacement of individual sections of ultra-thin Portland cement concrete surfaces as related to variables such as PCC thickness, transverse joint spacing, base preparation, and synthetic fibers.

This final report is the last of three reports issued on the ultra-thin Portland cement concrete overlay extension evaluation in field testing under the DOT project. It documents the construction, testing, and final performance evaluation of the ultra-thin whitetopping overlay with regard to surface preparation, PCC thickness, joint spacing, joint sealing, and concrete fiber variables. The test site location and arrangement of test variables are identified, along with annual test results from the summer of 1994 through the summer of 2004. It presents the results of deflection and visual distress surveys as they relate to original laboratory work. The report also details and evaluates the last ten years of pavement performance under the application of test variables, looks at the correlation of the results to those of the laboratory studies, and estimates the long-term performance of ultra-thin whitetopping, as affected by various elements, namely PCC thickness, base preparations, and joint configurations.

Research Objectives

The primary objective of the initial HR-559 project was to evaluate the bond characteristics between the concrete and asphalt as related to the following:

- Overlay thickness
- Slab size
- Surface preparation
- Synthetic fibers

As the focus of this report, the TR-432 extension project has sought to evaluate the degree of interface bonding between PCC and ACC layers over time. In conducting the research, joint spacing, PCC thickness, use of concrete fibers, surface preparation, and joint sealing were assigned as variables in determining the effectiveness of ultra-thin whitetopping under various conditions. Specifically, the objectives for the Iowa Highway 21 extension project (TR-432) were identified as the following:

- Evaluation of conventional methods of slab removal and asphalt surface preparation methods for subsequent overlays of Portland cement concrete in the “remove and replace” areas
- Evaluation of existing asphaltic concrete surface under the “remove and patch” areas of rehabilitation areas and evaluation of joint formation in the areas of patching
- Evaluation of polypropylene fiber enhanced concrete at the three-inch depth to determine the cost/benefit of its inclusion
- Evaluation of the performance of the rehabilitated ultra-thin whitetopping sections and the extended performance of the existing ultra-thin sections with and without patching
- Validate existing ultra-thin whitetopping design procedures of the PCA and ACPA for application in Iowa

This research sought to evaluate field performance and provide recommendations on design, materials, construction practices, and performance characteristics of ultra-thin whitetopping. The project included monitoring construction, conducting visual distress surveys after construction, and evaluating pavement performance as means for thorough research.

Research Approach

This research was conducted during a ten-year period. The first phase of the research, the HR-559 project, was concluded in July 1999, and the second phase, the TR-432 extension project, was concluded in August of 2004. The construction project chosen for the field research, IA 21 in Iowa County (project number STP-21-3 (10)—2C-48), provided the opportunity needed to achieve HR-559 research objectives. Test section length accounted for the entire length of the 7.16-mile PCC paving project. This first phase of research involved constructing an ultra-thin Portland cement concrete overlay under several variables according to the layout outlined in Table B.1. Paving took place in June and July of 1994, and the pavement was monitored quarterly during the five years of the initial project. At the closing of the HR-559 project in July 1999, the TR-432 extension project was implemented.

The TR-432 extension project (construction project number) extended over the five-year period from August 1999 through August 2004. Year 1, first summarized in the construction report of July 2000, involved the identification and rehabilitation of select areas of deteriorated whitetopping. Years 2–5 provided an evaluation period through which the performance of the pavement could be monitored. Similar to the first project, test sections were tested biannually with all tests being conducted during similar times of the day to ensure comparable results.

The testing consisted of performing Falling Weight Deflectometer (FWD) tests, conducting visual distress surveys in accordance with the Strategic Highway Research Program (SHRP), and obtaining core samples for a shear analysis of interface bonding. Under the direction of the principal investigator, research staff from Iowa State University and the Iowa Department of Transportation (Iowa DOT) provided the support necessary for the testing program. The ERES Consultants of Champaign, Illinois, performed FWD testing. Iowa DOT Office of Materials Special Investigations Unit obtained the coring samples and conducted the shear tests. The interim report of July 2002 documented preliminary results of such testing through the fall of 2001. This final report provides a comprehensive summary of the project's research, including construction, evaluation, and subsequent conclusions and recommendations.

TESTING PROGRAM

Location and Construction History

The test site is located south of Belle Plaine, Iowa, on a 7.2 mile stretch of IA 21 from US 6 to IA 212 in Iowa County. The site consists of 37,844 feet of continuous pavement between stations 2335+64 and 2714+08. A map of the project site can be found in Figure 1.

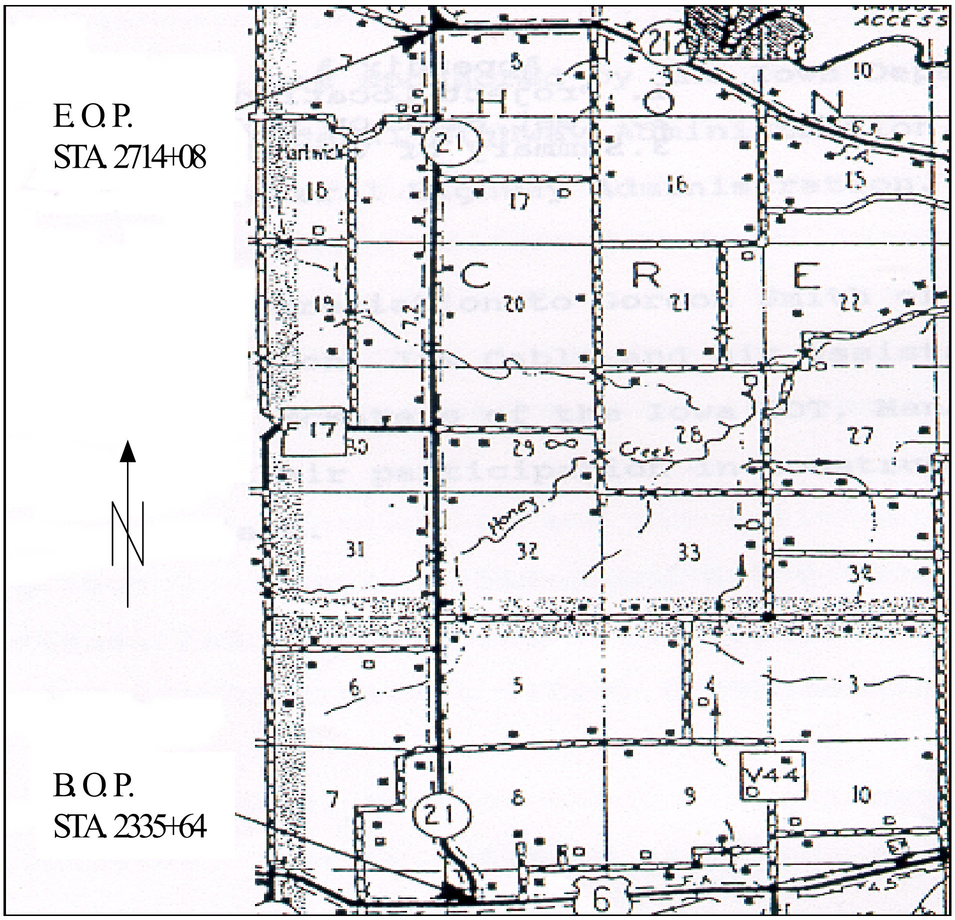


Figure 1. Project site map

The section of Iowa 21 chosen for research is a 24-foot-wide two-lane roadway, with 9-foot-wide granular shoulders and open ditch drainage. The existing alignment was graded in 1958, and it was comprised of a granular driving surface until 1961, at which time substantial improvements were made. Improvements included replacing the original sub-grade with select material, which is 2 feet deep, 24 feet wide, and centered on the roadbed. The select material was overlaid with 6 inches of granular material, 7 inches of cement treated sand (CTS), and 0.75 inches of chip seal. The 9-foot-wide granular shoulders were also constructed at this time. The chip seal provided a driving surface until 1964, when three inches of type B asphalt cement concrete (ACC) were laid. In 1987, a seal coat of negligible thickness was applied to the ACC surface. All layers of pavement were designed and placed according to Iowa State Highway Commission

(ISHC) or Iowa DOT specifications effective at the time of contract letting. Figure 2 below shows a detailed cross-section of the pavement and Figures D.1 through D.3 show rehabilitation-specific project cross-sections.

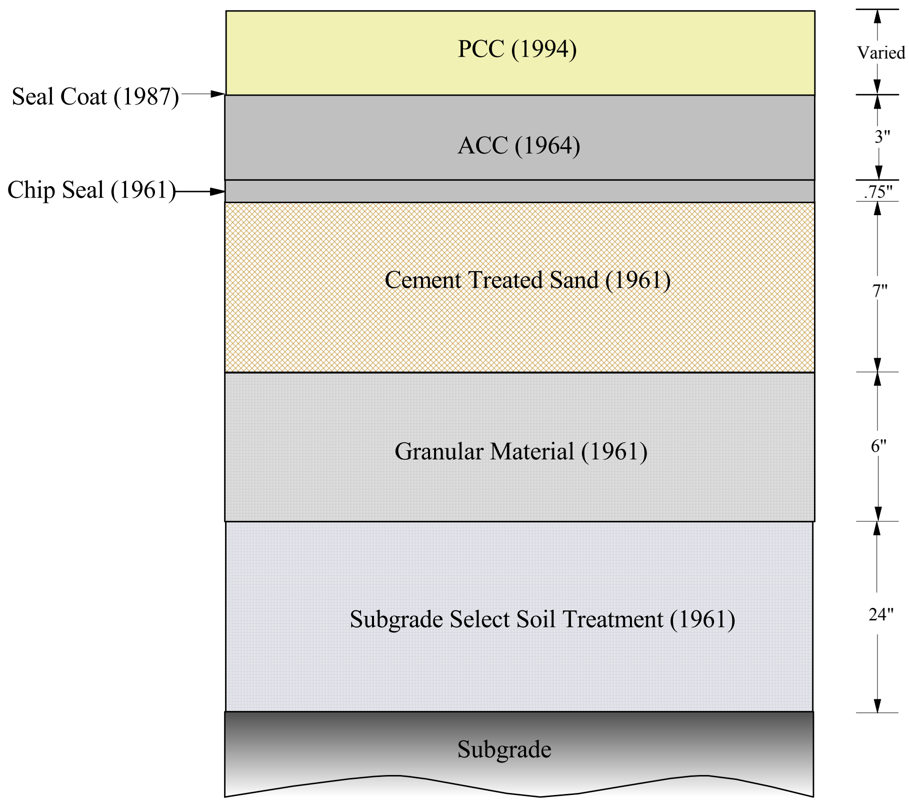


Figure 2. Pavement cross-section

HR-559 PCC Overlay Construction and Layout

Commencing in 1994, the HR-559 project involved placing a thin Portland cement concrete overlay on the existing ACC surface according to specific design variables:

- ACC surface preparation (milled, patched, and cold in-place recycle (CIPR))
- Use or non-use of synthetic fibers
- Pavement thickness (2, 4, 6, or 8 inches)
- Joint spacing (2 x 2, 4 x 4, 6 x 6, 12 x 12, 12 x 15, and 12 x 20 foot panels)
- Use or non-use of joint sealant

The test variables were effectively incorporated into the research by dividing the project into 65 sections ranging from 200 to 2700 feet in length, including 41 test sections as outlined in Table B.1. In applying these variable elements into the research, PCC depth ranged from 2 to 8 inches, slab sizes ranged from 2 feet squares to 15-by-12-foot panels, and fiber reinforcement was placed into the PCC mix from stations 2342+00 to 2415+00 and 2540+00 to 2631+00.

TR-432 Rehabilitation Construction and Layout

Commencing with the culmination of the HR-559 project in July 1999, sections of the PCC overlay were selected for rehabilitation. Selection of locations to be rehabilitated was based on observed pavement distress in the form of longitudinal and corner cracking. Fractured panels (panels broken into 4 or more pieces) and areas exhibiting characteristics of potential de-bonding were also chosen for replacement. In addition to individual panel rehabilitation, both lanes of a 130-foot section and the southbound lane of an 804-foot section were selected for lane replacement. The 804-foot section was found to be prepared with cold-in-place-recycling, which had exhibited characteristics of weak ACC base material. The location and size of the rehabilitated sections can be seen in Table A.2. As the long-term performance of non-rehabilitated sections of pavement is also of interest to this extended phase of research, the design variables for rehabilitated panels on this project were maintained to be identical to those existing during paving for the initial five-year phase of research. The construction project's contractor, Hawkeye Paving of Bettendorf, Iowa, provided the paving resources necessary to implement the research.

In August of 2001, additional sections of pavement were selected for rehabilitation. In several areas, PCC patching of all cracked or fractured panels was accomplished. In others, fractured panels were replaced and a 3-inch ACC overlay was placed over the sections. Minimal patch depth was 4 inches and new panels were cut to the same size as previous. Table A.3. identifies stations where patching done in 2001 occurred.

Rehabilitation Methods

Pavement rehabilitation consisted of joint sawing, panel removal, base preparation, and placement of new concrete. Panel removal began with the joints surrounding the panel being sawed to a depth of approximately 2¾ inches. Depending on size and proximity to the edge of pavement, panels to be replaced were either pulled or pried out laterally to the shoulder with a tractor or backhoe or lifted vertically with a backhoe and chains.
Prior to placing the new concrete patch, the underlying base was prepared such that maximum bonding could be achieved at the interface of the remaining ACC base and the new PCC patch. Crumbled pieces of ACC were easily removed with shovels and pick axes.

Following the removal of PCC panels, portions of deteriorated ACC were removed manually with the help of shovels, pick axes, and air hammers. When necessary, additional ACC was trimmed from the perimeters of the patch area with a hand-held demolition saw. Portable scarifiers were also used to attain the minimum PCC depth of three inches, if not already satisfied by panel removal. In cases where the portable scarifier was too large for the patch, the demolition saw could be used to make transverse and longitudinal cuts in the ACC base. Following scarification, compressed air was used to clean the surface of debris.

All paving and patching areas used an M-4 Portland cement concrete mix, a high early strength mix suitable for many applications. The mix was composed of 50% coarse and

50% fine aggregates of Class 3 durability. In select test sections, polypropylene fibers were mixed with the PCC in amounts comparable to those in the original HR-559 project. The fibers were incorporated into PCC mixes placed in all full-depth patching and paving locations, with the exception of the northbound lane of the 130-foot replacement section. To prevent shrinkage cracking, 1/8-inch joints for the panels were "soft-cut" to a depth of 1 inch within 2 to 3 hours of paving.

The maturity approach to estimating concrete strength was implemented to determine when the road could be opened to traffic. Maturity sensors placed into the pavement provided an indication of hydration through a correlation between time and temperature.

ACC Base Condition and Observations

Documentation of observed underlying ACC base conditions and interface bonding was a primary objective of this project. Table A.4. displays the removal depth and ACC/bonding conditions for all full-depth patching sections and the 130-foot lane replacement section during the 1999 patching. The removal of panels for rehabilitation provided researchers with an opportunity to visually inspect underlying ACC base conditions and subsequent degree of interface bonding. Within many sections, extensive deterioration of the ACC base was present in the form of brittle, crumbling asphalt and poor adhesion at the interface. In such cases, it was apparent that the absence of a firm base was not conducive to long-term performance of the overlay. However, it is difficult to draw sound conclusions in this respect, as yet other sections of deteriorated whitetopping revealed a solid base and high degree of bonding. The significance of base condition and preparation will be addressed further in following sections.

Soils and Base Types

Based on soil surveys taken by the United States Department of Agriculture, the local soil is primarily composed of the Downs-Fayette, Tama-Downs, and Colo-Bremer-Nevin-Nodaway Associations series. Of loess and glacial till origins, these soils are moderately well-drained and considered moderate to low in terms of their suitability for road construction. These soils generally exhibit low strength, moderate to high shrink/swell properties, and moderate to high freeze/thaw action. Corrosion to concrete due to the chemistry of these soil types is also considered to be moderate.

Soil surveys conducted at the site by the Iowa State Highway Commission (ISHC) prior to the 1958 grading operations provided more detailed soil information that reinforced the USDA surveys. Specifically, these soils were identified to be primarily fine grained, with the American Association of State Highway and Transportation Officials (AASHTO) classifications ranging from A-6 to A-7-6. Based on the ISHC survey, select soil treatment for the entire project was specified in the 1961 improvements.

Traffic Data

The section of Iowa Highway 21 under research serves primarily as a farm-to-market road and as an access route for US Highway 6. Private residences and intersections with lightly traveled county roads exist along the project. Currently, no commercial or industrial site exists adjacent to the project that may suggest heavy loads, localized high traffic volumes, or uneven directional distribution. An automatic weight in motion (WIM) device is located near the middle of the project and was used to estimate the number of equivalent single-axle loads (ESALs) that the site experienced. It should be mentioned that no distress was noted at the test site that can be attributed to traffic loadings at this time. The estimated number of ESALs for the test site (both lanes), as developed from the WIM data, is listed in Table 1 below.

Table 1. Traffic loads

Period	Northbound Lane ESALs	Southbound Lane ESALs
1995 - 1999	111,148	130,744
2000 - 2004	181,406	181,406
Total	**292,554**	**312,150**

Deflections

The FWD tests were conducted by ERES Consultants of Champaign, Illinois (see Figure 3). Testing was performed in the outside wheel path, 2 feet (0.6 m) from the outer edge, in each lane. Northbound lanes were tested between stations 2346+00 and 2694+50, and southbound lanes were tested between stations 2455+00 and 2697+25. FWD tests utilized seven deflection sensors placed at 0, 12, 24, 36, 48, 60, and 72 inches from the center of the load plate. Three test drops were conducted at each of 39 test locations with one drop per target load: 9,000, 12,000, and 16,000 force pounds. As indicated in the data tables, actual loads generated from the falling weights varied slightly from the target loads due to variations in pavement stiffness. Therefore, deflection measurements at each sensor were normalized for comparison between different test locations. The normalization was performed using linear interpolation. Ultimately, the results of the FWD testing were interpreted through calculating average deflection of basins and slopes between D_0 and D_1 as a representation of load transfer efficiency. The deflection load transfer efficiency was measured with the FWD by placing the load plate at the edge of the pavement section so only one of the slabs was loaded. Deflection sensors were placed equidistant from the joint, with one under the load and the remainder on the opposite side of the joint, and spaced at 12-inch intervals. The resulting assessment derived from the FWD tests is outlined under “Analysis and Results.” The sample test data is given in Appendix A, and graphs are available in Appendix B.

Figure 3. Falling Weight Deflectometer

Additionally, the Iowa DOT's Road Rater was used on this project as part of a separate study to correlate the results of the ERES Falling Weight Deflectometer and the Iowa DOT's Road Rater.

Figure 4. Measuring deflections with FWD and Road Rater

Visual Distress Surveys

Visual distress surveys were performed concurrently by the principal investigator and Iowa State University research staff. The tests were performed in the spring to identify the impact of freeze and thaw cycles and again in the fall to identify the impact of heavy loads on pavement performance. Completed in accordance with SHRP, the visual distress surveys consisted of a visual evaluation of the pavement surface for any signs of horizontal slab movement, spalling, or cracking. Graphs depicting the location and type of cracks at test location can be found in Tables B.1 through B.4. A discussion of the survey's results can be found in the Analysis and Results section.

Coring

Core samples of the pavement were obtained along the project three times during the project duration in order to examine ACC/PCC interface bond strength for each type of surface preparation and/or pavement deterioration. The Iowa DOT Office of Materials Special Investigations Unit drilled the 4-inch (102 mm) diameter core samples in groups of three in the northbound lane at select stations along the project. The locations of core samples and subsequent shear strength results can be found in Table 4 in the Analysis and Results section. The resulting cores allowed analysts to observe deterioration of the concrete layers and measure the shear strength of the ACC/PCC interface bond and the effectiveness of surface preparation techniques. Test results of the coring samples are discussed in the Analysis and Results section.

ANALYSIS AND RESULTS

Falling Weight Deflectometer Results

The results of the load transfer analysis are documented in Table A.5 and analyzed in Table A.6. The results of the analysis are illustrated in Figures C.1 through C.27 in Appendix C. The graphs in Appendix C display pavement performance with regard to the project variables through deflection measurements from the FWD. Overall, the graphs illustrate successful performance of the ultra-thin whitetopping in rehabilitating the pavement in this project. Each of the graphs reveals substantial improvement in deflection values immediately after construction. In many cases, the graphs show little variation in subsequent years, but rather sustainable performance indicative of a long-term potential for the ultra-thin whitetopping.

Figures C.1 through C.3 interpret deflection values for various PCC overlay depths over the duration of the research. Figure C.1 suggests that PCC overlays greater than 4 inches provide the most durable surface. Sections with 2 to 3 inches of pavement overlay showed significantly more distress and greater deflections, increasing at a distinctively more advanced rate than the thicker overlays. This behavior indicates the pavement is not acting like a composite, concrete section, but rather has greater flexibility and likely more movement below the overlay. Overlay thicknesses of 4 inches or greater appear better suited to resist this distress.

Similarly, in Figure C.2, most of the pavements show stability and very slow changes in deflection, which are the signs of a durable, long-lasting pavement. The exceptions were the three- and four-inch (measured depth) pavements which were more erratic, suggesting movement in the various layers of pavement (likely more closely affected by the environment during testing).

Figure C.3 shows the percent reduction in average deflections for the various overlay depths beginning with construction. In each case, there is a general decrease in the percent over time. Again, the 3-inch (measured depth) overlay is much more erratic depending on weather and is rapidly experiencing deflections closer to levels prior to the overlay. Also, as evident in Figure C.1, the more rapid return to pre-overlay deflection levels for 3-inch overlay depth sections indicates a significantly shorter life span for these sections of rehabilitation. Ongoing research has suggested that the return of deflections to previous levels before rehabilitation signals the end of the overlay's useful life.

Figures C.4 through C.12 show performance based on panel size for panels that are considerably less than twice in feet what the overlay pavement depth is in inches. For the 7-inch (measured depth) overlays, the 12′x12′ panels showed slight decreases in performance when compared to panels half the size. With a 5-inch (measured depth) overlay, the 2′x2′ and 4′x4′ panels yielded relatively consistent and comparable performance. Graphs for the 3-inch (measured depth) overlay were erratic with weaker performance.

Figures C.13 through C.21 display the effect of surface preparation techniques on PCC performance over time. They indicate fairly comparable performance between milling, patching, and cold in-place recycling with various pavement depths in terms of deflection. Fluctuations in deflection and percent reduction in deflection between testing periods show the strong effect of moisture and temperature on the pavement. Moderate temperatures and adequate pavement drainage seem to provide the best environment for this type of pavement. Each of the surface preparations' performance indicates that given normal weather conditions, they are able to maintain a composite structure over time. Warmer summer months appear to counter the harmful effects of cold winters, as CIPR and patched pavements have shown the ability to regain a strengthened bond.

The effects of synthetic fibers on ultra-thin whitetopping in this project are displayed in Figures C.22 through C.27. Falling weight deflectometer testing did not reveal significant gains in load transfer through the use of synthetic fibers. However, the graphs do suggest slight advantages may be gained as the depth of pavement decreases. As discussed in the visual survey results, in 2- and 3-inch (measured depth) overlays, fibers have a small effect on deflections with increased durability and the ability to hold the pavement together.

Visual Survey Results

Biannual visual surveys showed pavement distress occuring at varying degrees throughout the project, but ultimately yielded positive results for the ultra-thin whitetopping. In nearly every section, the pavement exhibited a survival rate of well over 90 percent over the ten-year study period. A subsequent statistical analysis of the pavement distress with regard to the four primary variables—pavement depth, panel size, surface preparation, and fiber use—did not reveal a significant correlation between pavement performance and any of the variables.

Therefore, to assist in developing conclusions related to the variables and ultra-thin performance, a visual inspection of bar graphs displaying the effects of variables on pavement survival proved effective. Each of the graphs in Appendix B was arranged to show the survival rate of various test sections of various configurations that best represent the variables considered in this research. Due to the strong performance of the sections, the range of the vertical axis was adjusted to better distinguish between small differences in performance.

Longitudinal was the most predominant distress, followed closely by transverse and corner cracking. Fractured slabs (failed slabs broken in 4 or more pieces) occurred only in isolated areas as a result of combined longitudinal and transverse or corner cracking. Sections with 2 inches of pavement overlay were the only ones to exhibit fractured slabs. Two-inch overlay depth sections with 2-foot panel sizes experienced less than 2 percent fractured slabs. Four-foot sections showed the most common occurrence of fractured slabs at less than 7 percent. Subsequently, of all sections, distress was most prevalent in 2-inch overlay depth sections with 4′x4′ square slabs, consistent with the commonly accepted industry guidelines which warn against pavement slab size in feet being more than twice the overlay pavement depth in inches.

It was observed from the graphs that milled surfaces left the pavement slightly more susceptible to longitudinal cracking; further, transverse cracking was more likely on surfaces prepared with patching. However, variations discernable from the graphs were minor, often less than 5 percent, and not statistically significant.

Detailed visual distress records (Appendices B.1-B.4) place the bulk of the longitudinal, transverse, and corner cracking at 18-30 inches (outer wheel path) from the pavement edge. This is the result of heavy loads on the joint and lack of edge support from the granular shoulder. Sections with edge support did not exhibit such cracking.

In sections with 4.5-inch asphalt, transverse cracking was the most prevalent in the form of traditional thermal cracking at 60- to 100-foot spacing. Some longitudinal cracking was noted within one foot of the pavement edge in years 5 to 10. It appears to be associated with edge rutting and wide, heavy farm vehicles in the area.

Fibers appeared to hold slab together, but did not prevent cracking. They provided toughness to restrain slab fragments in two-inch deep overlay distressed slabs from becoming dislodged from the pavement. The results of fiber performance are inconclusive at the 4-inch overlay depth and above.

Inspection of the charts in Appendix B and subsequent tables on the impact of variables on distress in Appendix A.7 does not reveal a significant correlation between panel size, surface preparation, or the use of fibers and pavement performance. However, the charts, as interpreted by Appendix A.7, show depth of pavement to have a notable impact on panel life. To assemble the table in Appendix A.7, the number of corner, longitudinal, transverse, and corner cracks within a given test section were totaled to allow for a comprehensive look at the influence of PCC depth on pavement distress.

Those test sections exhibiting 10 (1/year) or more signs of distress over the performance period are shown in Table 2. Table 2 indicates that panels with an excessive degree of cracking can largely be associated with the thinnest pavement, 2-inch overlays in this case.

As such, the likelihood that other factors may have significantly contributed to pavement distress is a useful consideration. In reviewing the visual distress data, it is of interest to note that many of the most severely deteriorated sections are newer sections that were rehabilitated in previous years due to excessive distress. This suggests that soils, drainage, or other base conditions may have a significant impact on pavement performance.

Table 2. Visual distress ranking

Section	Corner	Longitudinal	Transverse	Diagonal	All Cracks	Panel Size	PCC Thickness	Fiber	Surface Prep
53	38	103	316		457	4x4-6x6	2	F	CIPR
10	37	78	213	3	331	2x2	2	F	Milled
23	6	45	254		305	2x2	2	N	Milled
62	15	26	218		259	4x4	2	N	CIPR
39	21	15	69		105	4x4	2	F	Patch Only
52	48	16	1	3	68	2x2	2	F	CIPR
11	14	27			41	4x4	2	M	Milled
7	14	11			25	2x2	4	F	Milled
43		5	17		22	6x6	4	F	Patch Only
41		1	17		18	4x4	4	F	Patch Only
38	6	2	3	1	12	2x2	2	F	Patch Only
45	4	6	2		12	12x12	6	F	Patch Only
32	4	7			11	15x12	8	N	Patch Only

Table 3 displays test sections chosen for rehabilitation in 1999 and 2001 due to excessive distress. It can be noted that common characteristics of these most problematic sections are 2- or 4-inch PCC overlay thickness and 2′x2′ or 4′x4′ slab sizes. However, given that such variables yielded successful results in other test sections, it is important to consider that again after rehabilitation, the majority of these test sections rank highest among all test sections in terms of distress at the end of ten years. Notably, the four sections ranked with the most cracking are represented among these sections, suggesting that the cause of distress at these locations can be attributed to other factors, likely to the base preparation or sub-base support. As such, where 2-inch overlays and smaller panel sizes seem to perform well under more uniform site conditions, they may be a detriment to pavements built on weaker material and may leave pavements built on a poor base more susceptible to failure.

Table 3. Distress observed in rehabilitated sections

Rehabilitation	Test Section	Distress Rank	Observed Cracks	PCC Thickness	Panel Size
1999	7	11	25	4	2x2
1999	10	2	331	2	2x2
1999	11	14	41	2	4x4
1999	23	3	305	2	2x2
1999	52	9	68	2	2x2
2001	39	7	105	2	4x4
2001	52	9	68	2	2x2
2001	53	1	457	2	4x4
2001	61	39	3	6-2	4x4
2001	62	4	259	2	4x4

The project included a small amount of 6- and 8-inch overlay depths used for making connections to existing roads and completing the matrix of variables. The amount and type of visual distress is similar to those found in 2- and 4-inch overlay depths. These pavements performed at the same level as the thin overlays.

Lab Tests of Cores

Shear tests on core samples from locations along the project allowed researchers to determine the effectiveness of surface preparation techniques in providing a strong bond at the interface of the ACC base and PCC overlay. Table 4 displays average shear strengths derived from core samples taken along the project for each type of surface preparation studied: milled, patched, and CIPR. Values shown in the table represent the average of 3 or more core samples taken at a given station. The results of the shear test indicate more consistency and strength with milled surfaces, with patched being second, and CIPR being the hardest to control due to difficulty in ensuring that asphalt material is compacted and cured properly. All three base preparations showed an increase in bond overtime, perhaps due to thermal interactions between the concrete and asphalt, and the presence of loads on the pavement. Ultimately, each of the three base preparation techniques proved effective as long as the surface is clean, deteriorated base materials are sufficiently removed, and CIPR material is properly compacted.

Table 4. Average core shear strengths

				Average Shear Strength (psi)			
Section	**Station**	**Group**	**Variables**	**1997**	**1998**	**2001**	**2004**
6	2360	1	M,F,4″, 6′x6′	-	-	-	76
7	2365	2	M,F,4″, 2′x2′	-	-	-	153
8	2375	3	M,F,4″, 4′x4′	-	-	-	130
10	2380	4	M,F,2″, 2′x2′	84	76	92	-
11	2387	5	M,M,2″, 4′x4′	129	175	177	240
19	2434	6	M,N,6″, 6′x6′	-	-	-	170
26	2461	7	P,N,6″, 6′x6′	-	-	-	117
29	2485	8	P,N,4″, 4′x4′	-	-	-	110
38	2546	9	P,F,2″, 2′x2′	70	111	51	73
39	2553	10	P,F,2″, 4′x4′	53	51	57	100
41	2560	11	P,F,4″, 4′x4′	-	-	-	103
42	2565	12	P,F,4″, 2′x2′	-	-	-	115
45	2577	13	P,F,6″, 12′x12′	-	-	-	134
49	2605	14	C,F,4″, 2′x2′	-	-	-	130
52	2617	15	C,F,2″, 2′x2′	72	38	103	-
52	2624	16	C,F,2″, 2′x2′	83	67	128	-
55	2633	17	C,N,6″, 6′x6′	-	-	115	-
56	2640	18	C,N,6″, 12′x12′	-	-	99	-
56	2641	19	C,N,6″, 12′x12′	-	-	106	-
62	2691	20	C,N,2″, 4′x4′	88	-	113	-

<u>Variable Abbreviations:</u>

Col. 1: M = Milled P = Patch C = CIPR

Col. 2: M = Monofilliment F = Fibrolatted N = No Fiber

Design Validation

The information gathered from this project allowed the research team to validate the design concepts expressed in the PCA/ACPA and Colorado DOT/ERES design procedures. It is also serving as the basis for a new method of obtaining input values for those design procedures.

CONCLUSIONS

The following conclusions have been reached based on the data gathered during the study:

- Ultra-thin whitetopping exhibited exceptional performance (10+ years) and is an effective approach to pavement rehabilitation.
- Pavement deflections were significantly reduced with the addition of the ultra-thin overlays.
- Pavement deflections can be used to estimate the life of the overlay.
- Milling the base asphalt provides the highest bond from construction through the present day.
- Patching and CIPR base preparation provide bond at construction and show improved bond over time.
- The two-inch overlay depth performs adequately under a stable base, good overlay depth control, and good pavement drainage.
- The two-inch overlay depth performance is enhanced through the addition of fibers for durability.
- The two-inch overlay depth is limited in slab size to 4′x4′ for good performance.
- The four-inch overlay depth performed well over slab sizes from 2′x2′ to 6′x6′.
- The research has verified that slab size for ultra-thin overlays is limited to a length/width in feet equal to two times the overlay depth in inches.
- Fiber addition to the mix enhanced durability in two-inch overlay depth sections. It did not retard cracking, only enhanced integrity across cracks.
- Fiber addition to the mix for overlay depths of 4 or more inches exhibited no improvement in performance.
- Conventional partial depth patch techniques proved effective in rehabilitation of distressed ultra-thin slabs.
- Removal of all loose ACC material in the partial depth patch areas is essential to patch performance.
- Fiber addition to the patch material mix did enhance durability of the surface patches from the pavement rehabilitation.
- Attention to proper preparation of the asphalt base in a patch area is essential to the future performance of the PCC overlay patch material.
- Data from this study validates the PCA/ACPA and Colorado DOT/ERES design procedures.

FUTURE RESEARCH NEEDS AND IMPLEMENTATION

Future research in the areas of ultra-thin whitetopping should consider the following points in developing a matrix of design values to assist the engineer in selecting the right overlay depth, materials, and slab configuration:

- Careful consideration should be given to base and sub-base properties when applying ultra-thin overlays, notably when less than 4 inches.
- Adequate pavement drainage is an important factor in ensuring dependable pavement performance under varying environmental conditions.
- Attention should be given toward thorough surface preparation, including comprehensive removal of all deteriorated pavement material and cleaning the surface of matter that may interfere with bonding at the interface between the PCC and ACC layers.
- Alternative depths and slab sizes should be considered in various arrangements to best determine the most effective configuration.
- Installation of various fiber types under further variable configurations would be useful in determining when fiber reinforcement is most effective.
- Look at the impact of various depths of stress reliever layers on the performance of overlays.
- Study the impact of containment, such as installation of shoulders and curbs, to provide support to prevent the types of visual distress noted along this project, primarily in the outer wheel paths of the pavement.
- Examine the correlation of climate changes and traffic loadings to shear strength development over time.
- Investigate the impact of increased traffic volumes and truck loading on existing designs.

APPENDIX A: DATA TABLES

Table A.1 Test section stationing and arrangement

Section Number	Section Type	Station	PCC Depth (in.)	Synthetic Fiber *	Panel Size (ft x ft)	Surface Prep.
1	Recon	2335+64 - 2340+00	8	N	20 x 12	-
2	Trans	2340+00 - 2342+00	8 - 6	N, F	12 x 12	Milled
3	Test	2342+00 - 2349+00	6	F	12 x 12	Milled
4	Test	2349+00 - 2356+00	6	F	6 x 6	Milled
5	Trans	2356+00 - 2357+00	6 - 4	F	6 x 6	Milled
6	Test	2357+00 - 2364+00	4	F	6 x 6	Milled
7	Test	2364+00 - 2371+00	4	F	2 x 2	Milled
8	Test	2371+00 - 2378+00	4	F	4 x 4	Milled
9	Trans	2378+00 - 2380+00	4 - 2	F	2 x 2	Milled
10	Test	2380+00 - 2387+00	2	F	2 x 2	Milled
11	Test	2387+00 - 2394+00	2	M	4 x 4	Milled
12	Trans	2394+00 - 2396+00	2 - 6	M	4 x 4, 6 x 6	Milled
13	Test	2396+00 - 2403+00	6	M	6 x 6	Milled
14	Test	2403+00 - 2414+00	6	M	12 x 12	Milled
15	Trans	2414+00 - 2415+00	6 - 4.5	F	12 x 12, 6 x 6	Milled
16	Control	2415+00 - 2425+00	4.5 (1)	-	-	Milled
17	Trans	2425+00 - 2426+00	4.5 - 6	N	6 x 6, 12 x 12	Milled
18	Test	2426+00 - 2433+00	6	N	12 x 12	Milled
19	Test	2433+00 - 2440+00	6	N	6 x 6	Milled
20	Trans	2440+00 - 2441+00	6 - 4	N	6 x 6, 2 x 2	Milled
21	Test	2441+00 - 2448+00	4	N	2 x 2	Milled
22	Trans	2448+00 - 2449+00	4 - 2	N	2 x 2	Milled
23	Test	2449+00 - 2456+00	2	N	2 x 2	Milled
24	Trans	2456+00 - 2458+00	2 - 6	N	2 x 2, 6 x 6	Milled
25	Test	2458+00 - 2460+00	6	N	6 x 6	Milled
26	Test	2460+00 - 2468+00	6	N	6 x 6	Patch Only
27	Test	2468+00 - 2479+00	6	N	12 x 12	Patch Only
28	Trans	2479+00 - 2480+00	6 - 4	N	12 x 12, 4 x 4	Patch Only
29	Test	2480+00 - 2487+00	4	N	4 x 4	Patch Only
30	Trans	2487+00 - 2489+00	4 - 8	N	4 x 4, 15 x 12	Patch Only
31	Test	2489+00 - 2496+00	8	N	15 x 12	Patch Only
32	Test	2496+00 - 2503+00	8	N	15 x 12 D	Patch Only
33	Trans	2503+00 - 2505+00	8 - 4.5	N	15 x 12, 6 x 6	Patch Only
34	Control	2505+00 - 2515+00	4.5 (1)	-	-	Patch Only
35	Trans	2515+00 - 2516+00	4.5 - 6	N	4 x 4, 6 x 6	Patch Only
36	Test	2516+00 - 2538+00	6	N	6 x 6	Patch Only
37	Trans	2538+00 - 2540+00	6 - 2	N, F	6 x 6, 2 x 2	Patch Only
38	Test	2540+00 - 2547+00	2	F	2 x 2	Patch Only
39	Test	2547+00 - 2554+00	2	F	4 x 4	Patch Only
40	Trans	2554+00 - 2555+00	2 - 4	F	4 x 4	Patch Only

Table A.1 (continued)

Section Number	Section Type	Station	PCC Depth (in.)	Synthetic Fiber	Panel Size (ft x ft)	Surface Prep.
41	Test	2555+00 - 2562+00	4	F	4 x 4	Patch Only
42	Test	2562+00 - 2569+00	4	F	2 x 2	Patch Only
43	Test	2569+00 - 2576+00	4	F	6 x 6	Patch Only
44	Trans	2576+00 - 2577+00	4 - 6	F	6 x 6, 12 x 12	Patch Only
45	Test	2577+00 - 2585+00	6	F	12 x 12	Patch Only
46	Test	2585+00 - 2593+00	6	F	6 x 6	CIPR
47	Trans	2593+00 - 2594+00	6 - 4	F	6 x 6	CIPR
48	Test	2594+00 - 2601+00	4	F	6 x 6	CIPR
49	Test	2601+00 - 2608+00	4	F	2 x 2	CIPR
50	Test	2608+00 - 2615+00	4	F	4 x 4	CIPR
51	Trans	2615+00 - 2616+00	4 - 2	F	4 x 4, 2 x 2	CIPR
52	Test	2616+00 - 2624+00	2	F	2 x 2	CIPR
53	Test	2624+00 - 2631+00	2	F	4 x 4	CIPR
54	Trans	2631+00 - 2633+00	2 - 6	F	4 x 4, 6 x 6	CIPR
55	Test	2633+00 - 2640+00	6	N	6 x 6	CIPR
56	Test	2640+00 - 2653+00	6	N	12 x 12	CIPR
57	Trans	2653+00 - 2654+00	6 - 4	N	12 x 12, 6 x 6	CIPR
58	Test	2654+00 - 2661+00	4	N	6 x 6	CIPR
59	Trans	2661+00 - 2662+00	4 - 6	N	6 x 6, 12 x 12	CIPR
60	Test	2662+00 - 2689+00	6	N	6 x 6, 12 x 12	CIPR
61	Trans	2689+00 - 2691+00	6 - 2	N	12 x 12, 4 x 4	CIPR
62	Test	2691+00 - 2698+00	2	N	4 x 4	CIPR
63	Trans	2698+00 - 2700+00	2 - 6	N	12 x 12, 4 x 4	CIPR
64	Trans	2700+00 - 2704+00	6 - 4.5	N	12 x 12, 4 x 4	CIPR
65	Control	2704+00 - 2714+08	4.5 (1)	-	-	CIPR

Recon - reconstruction — N - no fibers
Trans - transition — F - fibrillated fibers
Control - ACC control — M - monofilament fibers
(1) ACC thickness — D - dowels

Table A.2 Rehabilitated sections: 1999

Patch Number	Station	Test Section	Panel Location*	Lane	Size (ft)	Quantity	Area (ft^2)
1	2369+37	7	R 5, 6	NBL	2 x 2	4	16
2	2380+32	10	R 5	NBL	2 x 2	7	28
3	2383+06	10	L 4	SBL	2 x 2	3	92
4	2383+46	10	R 2	NBL	2 x 2	2	8
5	2385+46	10	R 2	SBL	2 x 2	2	8
6	2384+17	10	R 5, 6	NBL	2 x 2	25	100
7	2384+60	10	R 5	NBL	2 x 2	9	36
8	2384+91	10	R 5	NBL	2 x 2	2	8
9	2385+13	10	L 4	SBL	2 x 2	24	96
10	2385+52	10	R 5, 6	NBL	2 x 2	29	116
11	2386+37	10	L 1	SBL	2 x 2	3	12
12	2386+43	10	L 4	SBL	2 x 2	2	8
13	2386+59	10	L 4	SBL	2 x 2	8	32
14	2386+75	10	L 5	NBL	2 x 2	2	8
15	2389+11	11	R 3	NBL	4 x 4	7	112
16	2389+83	11	R 3	SBL	2 x 2	19	304
17	2391+20	11	L 2	NBL	2 x 2	5	80
18	2392+18	11	R 3	SBL	2 x 2	40	640
19	2392+50	11	L 3	SBL	2 x 2	21	336
20	2448+14	22	L 2 – 6	SBL	2 x 2	65	260
21	2454+48	23	R 1 – 6	NBL	2 x 2	390	1560
(end of pave)	2455+78	23					
22	2454+48	23	L 1 – 6	SBL	2 x 2	390	1560
(end of pave)	2455+78	23					
23	2550+67	23	L 3	SBL	2 x 2	8	128
24	2552+16	23	L 3	SBL	2 x 2	3	48
25	2552+83	23	L 3	SBL	2 x 2	12	192
26	2553+60	23	R 3	NBL	2 x 2	1	16
27	2622+00	52	L 3 – 5	SBL	2 x 2	17	68
28	2623+00	52	L 5, 6	SBL	2 x 2	16	64

NBL = North Bound Lane
SBL = South Bound Lane
* For example, "R 3" indicates that a removal area is located three panels to the right of the center line when oriented from South to North

Table A.3 Rehabilitated sections: 2001

Station	Test Section	Lane	Dimension (ft)	Existing Depth (in)	Panel Size (ft)
2364+00	7	R	44 x 6	4	4 x 4
2364+00	7	L	6 x 6	4	4 x 4
2368+00	7	R	6 x 4	4	2 x 2
2369+26	7	R	2 x 2	4	2 x 2
2369+30	7	R	2 x 4	4	2 x 2
2369+36	7	R	2 x 4	4	2 x 2
2369+44	7	R	2 x 2	4	2 x 2
2369+64	7	R	2 x 4	4	2 x 2
2383+72	10	L	6 x 4	2	2 x 2
2384+20	10	R	34 x 2	2	2 x 2
2384+46	10	R	8 x 4	2	2 x 2
2385+86	10	R	34 x 4	2	2 x 2
2389+40	11	R	28 x 4	2	4 x 4
2389+92	11	L	12 x 12	2	4 x 4
2390+36	11	R	12 x 4	2	4 x 4
2391+72	11	R	52 x 4	2	4 x 4
2391+72	11	L	12 x 4	2	4 x 4
2391+96	11	L	16 x 4	2	4 x 4
2393+28	11	L	32 x 4	2	4 x 4
2393+72	11	R	28 x 4	2	4 x 4
2447+68	21	L	4 x 2	4	2 x 2
2448+16	22	L	14 x 6	4	2 x 2
2456+00	24	R	6 x 12	2	6 x 6
2538+36	37	R	24 x 6	6	6 x 6
2541+20	38	L	4 x 4	2	2 x 2
2541+20	38	L	6 x 2	2	2 x 2
2541+20	38	R	2 x 2	2	2 x 2
2546+68	38	L	2 x 4	2	2 x 2
2547+00	39	R	12 x 4	2	4 x 4
2547+60	39	L	8 x 4	2	4 x 4
2547+84	39	L	4 x 4	2	4 x 4
2548+36	39	R	4 x 12	2	4 x 4
2549+00	39	L	16 x 4	2	4 x 4
2549+04	39	R	8 x 4	2	4 x 4
2550+36	39	L	4 x 4	2	4 x 4
2551+00	39	L	44 x 8	2	4 x 4
2551+36	39	L	12 x 4	2	4 x 4
2553+44	39	L	4 x 4	2	4 x 4
2623+84	52	L	60 x 6	2	2 x 2
2623+84	52	R	6 x 8	2	2 x 2
2623+50	52	L	32 x 2	2	2 x 2
2625+50	53	L	8 x 12	2	4 x 4
2625+60	53	R	8 x 12	2	4 x 4
2689+20	61	L	48 x 6	6	12 x 12
2692+16	62	L	20 x 8	2	4 x 4
2692+32	62	R	16 x 4	2	4 x 4

Table A.4 Removal depth and ACC/bonding condition at rehabilitated sections

Patch Number	Station	Test Section	Removal Depth	Bonding/ACC Condition
1	2369+37	7	4	Good condition; PCC adhered to ACC to a high degree and ACC maintained form
2	2380+32	10	4.5 – 5.25	ACC looser and more prone to crumbling when compared to section 1, yet still retaining some form; ACC did not come out with panels - nearly all of it had to be chipped away
3	2383+06	10	3.5	High degree of bonding: nearly all of the ACC stuck with the PCC, and remained in good condition
4	2383+46	10	3.5 - 4	Subsurface condition similar to section 2; little of the ACC came up with the panels
5	2385+46	10	3 – 3.5	Difficult to determine; only 2 panels at this section; the first panel was pulled out, which may have disrupted the second one; it is suspected that the condition is much like that of Section 3
6	2384+17	10	3.5 - 4	ACC in good condition with significant amount remaining with the panels
7	2384+60	10	4 – 4.75	At least half of the ACC did not remain with the PCC; ACC partially maintained its form
8	2384+91	10	4.5 – 4.75	ACC was partially loose and crumbled somewhat; about half of it remained with the panels
9	2385+13	10	4	Very good condition; nearly all of the ACC came up with no problems
10	2385+52	10	4	ACC crumbled somewhat; some remained with the PCC
11	2386+37	10	4	ACC came out nicely; good bonding
12	2386+43	10	3.75 - 4	High degree of bonding with ACC in good condition
13	2386+59	10	3.75 - 4	High degree of bonding with ACC in good condition
14	2386+75	10	3.75 - 4	Situation similar to that of section 5
15	2389+11	11	3 – 3.25	Very good bond; nearly all of the ACC adhered to the PCC, and ACC was in good form
16	2389+83	11	4 – 4.5	Situation similar to that of section 15
17	2391+20	11	3.5 - 4	Situation similar to that of section 15
18	2392+18	11	3.75	Good bond; nearly all of the ACC adhered to the PCC; ACC was in good form
19	2392+50	11	Unknown	Situation similar to that of section 18
20	2448+14	22	4	ACC crumbled; much of it did not remain with the panels during removal
21	2454+48	23	3 -4.25	Poor interface bonding; ACC crumbled easily
22	2454+48	23	3.25 – 5	Poor interface bonding; ACC crumbled easily
23	2550+67	23	3.25 - 5	Unknown
24	2552+16	23	3 – 4.5	ACC adhered to the panels
25	2552+83	23	4.5	ACC adhered to the panels
26	2553+60	23	4 – 4.25	Unknown
27	2622+00	52	4	A portion of ACC adhered to most of the panels; ACC crumbled somewhat
28	2623+00	52	4	Unknown

Table A.5 Falling Weight Deflectometer results

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
234600	1	NB	3	-	8.75	-	-	-	8445	9000	19.46	14.07	7.81	4.92	-0.44938	21.00986	0	0	0	0
234600	2	NB	3	M	8.75	F	12	C	9985	9000	2.74	2.42	2.10	1.81	-0.02629	29.78289	85.92	82.76	73.12	63.20
234600	3	NB	3	M	8.75	F	12	C	11741	9000	3.27	3.03	2.27	2.23	-0.02044	29.50820	83.18	78.48	70.95	54.70
234600	4	NB	3	M	8.75	F	12	C	10373	9000	3.69	3.38	2.98	2.49	-0.02603	30.72000	81.05	76.01	61.90	49.43
234600	5	NB	3	M	8.75	F	12	C	9311	9000	3.26	3.05	2.71	2.38	-0.01692	31.60237	83.26	78.29	65.35	51.71
234600	6	NB	3	M	8.75	F	12	C	9793	9000	6.32	4.09	3.31	2.49	-0.18583	22.41456	67.52	70.93	57.63	49.43
234600	7	NB	3	M	8.75	F	12	C	9206	9000	6.09	5.94	5.34	4.65	-0.01250	32.80788	68.71	57.78	31.64	5.56
234600	8	NB	3	M	8.75	F	12	C	11006	9000	7.17	5.99	4.64	3.58	-0.09833	26.78661	63.16	57.42	40.60	27.29
234600	9	NB	3	M	8.75	F	12	C	10150	9000	4.69	4.12	3.17	2.48	-0.04750	27.82516	75.90	70.71	59.42	49.63
234600	10	NB	3	M	8.75	F	12	C	9984	9000	6.25	4.35	3.32	2.80	-0.15833	23.41440	67.88	69.08	57.50	43.13
235400	1	NB	4	-	5.00	-	-	-	8029	9000	40.87	24.35	10.88	5.73	-1.37688	17.18541	0	0	0	0
235400	2	NB	4	M	5.00	F	6	C	8756	9000	7.31	6.15	4.79	3.57	-0.09679	26.88608	82.12	74.75	55.99	37.73
235400	3	NB	4	M	5.00	F	6	C	11127	9000	7.16	6.10	4.18	3.62	-0.08830	26.26441	82.49	74.95	61.58	36.88
235400	4	NB	4	M	5.00	F	6	C	9409	9000	7.84	6.61	5.10	3.63	-0.10283	26.68537	80.81	72.85	53.16	36.71
235400	5	NB	4	M	5.00	F	6	C	8467	9000	6.95	6.14	5.06	4.07	-0.06732	28.85321	82.99	74.77	53.51	28.93
235400	6	NB	4	M	5.00	F	6	C	9475	9000	10.56	9.18	6.98	4.88	-0.11500	27.13636	74.16	62.29	35.87	14.80
235400	7	NB	4	M	5.00	F	6	C	9206	9000	9.28	8.72	7.70	6.63	-0.04667	31.51940	77.29	64.18	29.26	-15.75
235400	8	NB	4	M	5.00	F	6	C	10194	9000	13.48	11.81	8.40	5.71	-0.13917	26.53264	67.02	51.49	22.82	0.31
235400	9	NB	4	M	5.00	F	6	C	9042	9000	10.28	8.81	6.43	4.52	-0.12250	26.42802	74.85	63.81	40.92	21.09
235400	10	NB	4	M	5.00	F	6	C	9936	9000	12.01	9.73	6.99	5.00	-0.19000	25.20400	70.61	60.04	35.78	12.71
235950	1	NB	6	-	6.00	-	-	-	8391	9000	28.85	17.89	9.04	4.59	-0.91348	18.15613	0	0	0	0
235950	2	NB	6	M	6.00	F	6	C	9042	9000	5.71	4.65	3.71	2.91	-0.08875	26.61324	80.20	74.02	58.94	36.69
235950	3	NB	6	M	6.00	F	6	C	10721	9000	5.29	4.65	3.37	3.10	-0.05317	27.70476	81.67	74.00	62.77	32.52
235950	4	NB	6	M	6.00	F	6	C	10253	9000	5.56	4.95	3.97	2.94	-0.05047	28.43602	80.74	72.33	56.12	35.94
235950	5	NB	6	M	6.00	F	6	C	8423	9000	5.81	5.09	4.08	3.19	-0.06055	28.22426	79.85	71.57	54.86	30.41
235950	6	NB	6	M	6.00	F	6	C	9398	9000	7.78	5.35	4.28	3.21	-0.20250	23.32905	73.04	70.10	52.66	30.08
235950	7	NB	6	M	6.00	F	6	C	9151	9000	9.18	6.31	5.64	5.01	-0.23917	24.89542	68.18	64.73	37.62	-9.14
235950	8	NB	6	M	6.00	F	6	C	10633	9000	13.65	7.72	5.82	4.09	-0.49417	19.70110	52.69	56.85	35.63	10.91
235950	9	NB	6	M	6.00	F	6	C	8800	9000	8.67	5.60	4.28	3.10	-0.25583	21.82007	69.95	68.70	52.66	32.47
235950	10	NB	6	M	6.00	F	6	C	9808	9000	10.74	6.07	4.69	3.60	-0.38917	20.03352	62.78	66.07	48.13	21.58
237000	1	NB	7	-	5.00	-	-	-	9398	9000	29.35	18.14	9.88	6.09	-0.93451	18.70082	0	0	0	0

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
237000	2	NB	7	M	5.00	F	2	C	9064	9000	8.19	6.27	4.79	3.59	-0.16053	24.82182	72.09	65.46	51.57	40.98
237000	3	NB	7	M	5.00	F	2	C	10775	9000	8.64	7.97	5.11	4.18	-0.05568	27.07544	70.58	56.07	48.28	31.43
237000	4	NB	7	M	5.00	F	2	C	9804	9000	7.83	6.77	5.40	3.79	-0.08874	27.54513	73.32	62.70	45.38	37.75
237000	5	NB	7	M	5.00	F	2	C	8445	9000	9.47	8.05	5.88	4.17	-0.11901	26.28121	67.72	55.64	40.48	31.58
237000	6	NB	7	M	5.00	F	2	C	9453	9000	11.08	9.72	7.00	5.30	-0.11333	26.97834	62.25	46.41	29.17	12.98
237000	7	NB	7	M	5.00	F	2	C	9173	9000	9.46	9.07	8.07	7.05	-0.03250	32.21353	67.77	49.99	18.34	-15.75
237000	8	NB	7	M	5.00	F	2	C	10315	9000	10.73	9.34	6.81	4.92	-0.11583	26.81267	63.44	48.51	31.09	19.22
237000	9	NB	7	M	5.00	F	2	C	8811	9000	8.52	7.22	5.36	3.87	-0.10833	26.44366	70.97	60.19	45.77	36.46
237000	10	NB	7	M	5.00	F	2	C	9712	9000	11.23	9.30	6.73	4.96	-0.16083	25.77916	61.74	48.73	31.90	18.56
237450	1	NB	8	-	7.00	-	-	-	8182	9000	23.37	15.93	8.73	5.14	-0.62057	19.97929	0	0	0	0
237450	2	NB	8	M	7.00	F	4	C	9195	9000	5.13	4.91	4.59	2.78	-0.01794	31.48855	78.06	69.15	47.44	45.89
237450	3	NB	8	M	7.00	F	4	C	10896	9000	5.63	5.09	3.70	3.48	-0.04474	28.45815	75.94	68.05	57.63	32.30
237450	4	NB	8	M	7.00	F	4	C	9694	9000	5.73	5.12	4.25	3.33	-0.05029	29.13452	75.49	67.82	51.31	35.12
237450	5	NB	8	M	7.00	F	4	C	8193	9000	6.31	5.56	4.72	3.72	-0.06225	29.11150	73.02	65.10	45.92	27.51
237450	6	NB	8	M	7.00	F	4	C	9661	9000	7.50	6.63	5.47	4.25	-0.07250	28.76000	67.91	58.37	37.37	17.27
237450	7	NB	8	M	7.00	F	4	C	8888	9000	7.60	7.19	6.74	6.17	-0.03417	32.86579	67.49	54.86	22.83	-20.11
237450	8	NB	8	M	7.00	F	4	C	10117	9000	9.43	8.55	7.17	5.52	-0.07333	29.51644	59.66	46.32	17.91	-7.46
237450	9	NB	8	M	7.00	F	4	C	9053	9000	7.30	6.59	5.36	4.14	-0.05917	29.04658	68.77	58.63	38.63	19.41
237450	10	NB	8	M	7.00	F	4	C	9648	9000	8.23	7.28	5.71	4.40	-0.07917	28.14824	64.79	54.29	34.62	14.34
238550	1	NB	10	-	3.00	-	-	-	8686	9000	29.93	18.55	9.88	5.29	-0.94894	18.45898	0	0	0	0
238550	2	NB	10	M	3.00	F	2	C	8274	9000	17.36	12.75	7.23	4.56	-0.38434	21.38722	42.01	31.26	26.82	13.92
238550	3	NB	10	M	3.00	F	2	C	10775	9000	14.31	10.73	6.15	4.39	-0.29791	22.00000	52.20	42.13	37.81	17.02
238550	4	NB	10	M	3.00	F	2	C	9607	9000	14.76	10.75	6.87	4.22	-0.33413	22.03553	50.68	42.01	30.53	20.38
238550	5	NB	10	M	3.00	F	2	C	8380	9000	19.90	14.40	8.57	5.11	-0.45823	21.39342	33.52	22.35	13.30	3.45
238550	6	NB	10	M	3.00	F	2	C	10308	9000	21.67	12.19	7.85	4.83	-0.79000	18.43470	27.61	34.28	20.59	8.78
238550	7	NB	10	M	3.00	F	2	C	8921	9000	26.04	16.29	13.72	10.44	-0.81250	22.23502	13.01	12.17	-38.80	-97.18
238550	8	NB	10	M	3.00	F	2	C	10369	9000	27.16	17.18	8.94	4.93	-0.83167	18.62960	9.27	7.37	9.56	6.89
238550	9	NB	10	M	3.00	F	2	C	N/A	9000	N/A	N/A	N/A	N/A			#VALUE!	#VALUE!	#VALUE!	#VALUE!
238550	10	NB	10	M	3.00	F	2	C	9592	9000	13.99	9.95	6.22	4.60	-0.33667	21.84274	53.26	46.35	37.08	13.12
239150	1	NB	11	-	3.00	-	-	-	8073	9000	25.98	18.61	10.90	6.33	-0.61408	21.09528	0	0	0	0
239150	2	NB	11	M	3.00	M	4	C	9108	9000	10.12	9.19	6.69	4.26	-0.07740	27.35742	61.05	50.61	38.64	32.74
239150	3	NB	11	M	3.00	M	4	C	10764	9000	12.82	10.13	6.32	4.72	-0.22366	23.61644	50.65	45.54	42.02	25.40
239150	4	NB	11	M	3.00	M	4	C	9771	9000	11.98	9.81	6.95	4.62	-0.18115	25.10223	53.87	47.28	36.22	26.98

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
239150	5	NB	11	M	3.00	M	4	C	8347	9000	14.67	11.46	8.02	5.35	-0.26776	24.11903	43.51	38.40	26.42	15.54
239150	6	NB	11	M	3.00	M	4	C	9727	9000	15.93	13.13	8.89	5.72	-0.23333	24.74200	38.67	29.43	18.46	9.67
239150	7	NB	11	M	3.00	M	4	C	8932	9000	16.54	15.33	13.07	11.16	-0.10083	30.65296	36.32	17.61	-19.88	-76.24
239150	8	NB	11	M	3.00	M	4	C	10304	9000	18.79	15.44	10.38	6.43	-0.27917	24.54284	27.66	17.02	4.80	-1.54
239150	9	NB	11	M	3.00	M	4	C	8603	9000	19.07	15.07	9.67	5.66	-0.33333	23.34872	26.58	19.01	11.31	10.62
239150	10	NB	11	M	3.00	M	4	C	9688	9000	20.94	15.89	9.37	5.56	-0.42083	22.06877	19.39	14.60	14.06	12.20
239950	1	NB	13	-	7.30	-	-	-	8566	9000	24.33	16.40	8.74	4.80	-0.66104	19.58290	0	0	0	0
239950	2	NB	13	M	7.30	M	6	C	9228	9000	4.10	3.70	3.13	2.57	-0.03332	29.77143	83.17	77.46	64.19	46.38
239950	3	NB	13	M	7.30	M	6	C	10666	9000	4.70	4.33	3.28	2.73	-0.03094	28.92280	80.69	73.61	62.45	43.06
239950	4	NB	13	M	7.30	M	6	C	9815	9000	4.47	4.01	3.37	2.78	-0.03821	29.56879	81.65	75.57	61.40	42.14
239950	5	NB	13	M	7.30	M	6	C	8467	9000	4.39	3.98	3.54	3.10	-0.03455	30.78450	81.96	75.76	59.51	35.36
239950	6	NB	13	M	7.30	M	6	C	9409	9000	8.62	6.38	4.82	3.60	-0.18667	24.09745	64.58	61.10	44.86	25.02
239950	7	NB	13	M	7.30	M	6	C	9140	9000	8.18	4.95	4.51	4.30	-0.26917	23.03178	66.38	69.82	48.41	10.45
239950	8	NB	13	M	7.30	M	6	C	10260	9000	9.45	6.49	4.96	3.74	-0.24667	22.91429	61.16	60.43	43.26	22.11
239950	9	NB	13	M	7.30	M	6	C	9470	9000	6.40	4.44	3.46	2.70	-0.16333	23.34375	73.70	72.93	60.42	43.77
239950	10	NB	13	M	7.30	M	6	C	9688	9000	9.38	5.21	4.22	3.44	-0.34750	20.26439	61.45	68.23	51.72	28.36
240950	1	NB	14	-	7.00	-	-	-	8467	9000	31.75	20.88	10.75	5.90	-0.90617	19.06662	0	0	0	0
240950	2	NB	14	M	7.00	M	12	C	8460	9000	4.47	3.79	3.33	2.66	-0.05674	28.68571	85.93	81.86	69.01	54.92
240950	3	NB	14	M	7.00	M	12	C	10161	9000	5.47	4.89	3.58	3.39	-0.04872	28.28155	82.76	76.58	66.70	42.50
240950	4	NB	14	M	7.00	M	12	C	9880	9000	5.58	5.02	4.35	3.53	-0.04706	29.92170	82.41	75.96	59.57	40.09
240950	5	NB	14	M	7.00	M	12	C	8106	9000	5.48	4.93	4.15	3.36	-0.04626	29.55061	82.73	76.39	61.36	42.97
240950	6	NB	14	M	7.00	M	12	C	9442	9000	9.79	6.14	4.75	3.76	-0.30417	21.65271	69.17	70.59	55.80	36.26
240950	7	NB	14	M	7.00	M	12	C	9075	9000	9.44	4.96	4.49	4.43	-0.37333	20.82839	70.27	76.24	58.22	24.91
240950	8	NB	14	M	7.00	M	12	C	9985	9000	13.49	5.78	4.62	3.61	-0.64250	16.85693	57.51	72.31	57.01	38.81
240950	9	NB	14	M	7.00	M	12	C	8724	9000	10.15	4.61	3.70	2.95	-0.46167	17.56847	68.03	77.92	65.57	49.99
240950	10	NB	14	M	7.00	M	12	C	9616	9000	11.03	5.64	4.56	3.68	-0.44917	19.09882	65.26	72.98	57.57	37.62
242825	1	NB	18	-	7.00	-	-	-	8697	9000	21.11	15.74	10.07	6.32	-0.44757	22.46765	0	0	0	0
242825	2	NB	18	M	7.00	N	12	C	9151	9000	2.91	2.68	2.27	1.91	-0.01885	30.36486	86.21	82.94	77.44	69.82
242825	3	NB	18	M	7.00	N	12	C	10326	9000	4.89	4.38	3.16	3.03	-0.04285	28.20321	76.84	72.20	68.66	52.03
242825	4	NB	18	M	7.00	N	12	C	9585	9000	4.77	3.57	3.07	2.54	-0.10016	25.88976	77.41	77.33	69.51	59.90
242825	5	NB	18	M	7.00	N	12	C	8128	9000	4.79	4.21	3.54	2.95	-0.04891	29.08545	77.29	73.27	64.81	53.42
242825	6	NB	18	M	7.00	N	12	C	10253	9000	5.99	5.31	4.49	3.47	-0.05667	29.10851	71.63	66.26	55.41	45.12
242825	7	NB	18	M	7.00	N	12	C	9316	9000	5.60	5.59	5.17	4.61	-0.00083	33.99643	73.47	64.49	48.65	27.09

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
242825	8	NB	18	M	7.00	N	12	C	10611	9000	8.15	7.07	5.71	4.47	-0.09000	28.10798	61.39	55.08	43.29	29.30
242825	9	NB	18	M	7.00	N	12	C	8570	9000	5.42	4.91	3.85	3.06	-0.04250	28.78229	74.33	68.81	61.76	51.60
242825	10	NB	18	M	7.00	N	12	C	9632	9000	6.99	6.24	4.86	3.92	-0.06250	28.42060	66.89	60.36	51.73	38.00
243650	1	NB	19	-	9.00	-	-	-	8369	9000	23.45	14.73	9.54	5.95	-0.72679	19.93948	0	0	0	0
243650	2	NB	19	M	9.00	N	6	C	9327	9000	3.81	3.23	2.72	2.22	-0.04825	28.23797	83.75	78.06	71.47	62.68
243650	3	NB	19	M	9.00	N	6	C	11050	9000	3.21	2.98	2.24	2.21	-0.01900	29.64975	86.32	79.77	76.52	62.88
243650	4	NB	19	M	9.00	N	6	C	10078	9000	3.04	2.70	2.27	1.84	-0.02828	29.25882	87.05	81.69	76.22	69.07
243650	5	NB	19	M	9.00	N	6	C	8511	9000	2.92	2.64	2.35	1.92	-0.02291	30.47826	87.56	82.06	75.39	67.64
243650	6	NB	19	M	9.00	N	6	C	9322	9000	4.17	3.81	3.19	2.63	-0.03000	29.92806	82.22	74.14	66.56	55.78
243650	7	NB	19	M	9.00	N	6	C	9250	9000	6.48	6.28	5.80	5.00	-0.01667	33.00000	72.37	57.37	39.20	15.92
243650	8	NB	19	M	9.00	N	6	C	10534	9000	5.46	5.03	3.85	3.00	-0.03583	28.81319	76.72	65.86	59.64	49.55
243650	9	NB	19	M	9.00	N	6	C	8811	9000	3.68	3.34	2.57	2.00	-0.02833	28.53261	84.31	77.33	73.06	66.37
243650	10	NB	19	M	9.00	N	6	C	9528	9000	5.43	4.48	3.45	2.96	-0.07917	26.79558	76.85	69.59	63.83	50.23
244500	1	NB	21	-	4.00	-	-	-	9125	9000	20.64	14.60	8.61	5.42	-0.50384	21.06737	0	0	0	0
244500	2	NB	21	M	4.00	N	2	C	8932	9000	4.51	3.91	3.17	2.50	-0.05038	28.15179	78.13	73.22	63.14	53.93
244500	3	NB	21	M	4.00	N	2	C	10874	9000	5.36	4.68	3.33	3.03	-0.05656	27.31481	74.02	67.91	61.36	44.16
244500	4	NB	21	M	4.00	N	2	C	9694	9000	5.77	4.86	3.92	3.00	-0.07505	27.40097	72.07	66.67	54.50	44.72
244500	5	NB	21	M	4.00	N	2	C	8248	9000	5.76	4.98	3.95	3.13	-0.06547	27.85227	72.09	65.91	54.12	42.27
244500	6	NB	21	M	4.00	N	2	C	9869	9000	6.53	5.73	4.49	3.43	-0.06667	27.93262	68.37	60.75	47.85	36.77
244500	7	NB	21	M	4.00	N	2	C	9316	9000	6.10	5.93	5.59	5.02	-0.01417	33.60000	70.45	59.38	35.08	7.46
244500	8	NB	21	M	4.00	N	2	C	10337	9000	7.18	6.29	4.96	3.72	-0.07417	27.91086	65.22	56.91	42.40	31.42
244500	9	NB	21	M	4.00	N	2	C	8756	9000	5.46	4.89	3.70	2.78	-0.04750	27.93407	73.55	66.50	57.03	48.75
244500	10	NB	21	M	4.00	N	2	C	9520	9000	7.86	6.93	5.11	4.04	-0.07750	27.46565	61.92	52.53	40.65	25.53
245500	1	NB	23	-	3.00	-	-	-	7755	9000	25.80	16.11	7.93	4.26	-0.80754	18.17004	0	0	0	0
245500	2	NB	23	M	3.00	N	2	C	8745	9000	9.75	7.62	4.66	3.22	-0.17753	23.10032	62.22	52.72	41.18	24.37
245500	3	NB	23	M	3.00	N	2	C	10819	9000	10.92	8.43	5.19	3.83	-0.20797	23.06778	57.66	47.69	34.51	9.96
245500	4	NB	23	M	3.00	N	2	C	9256	9000	10.37	7.82	5.25	3.47	-0.21229	23.13884	59.82	51.47	33.76	18.50
245500	5	NB	23	M	3.00	N	2	C	7996	9000	11.15	8.64	5.62	3.65	-0.20917	23.30373	56.76	46.34	29.14	14.38
245500	6	NB	23	M	3.00	N	2	C	9420	9000	11.91	9.58	6.72	4.70	-0.19417	24.79093	53.84	40.53	15.22	-10.35
245500	7	NB	23	M	3.00	N	2	C	9130	9000	12.89	9.60	8.43	7.15	-0.27417	26.11327	50.04	40.40	-6.35	-67.87
245500	8	NB	23	M	3.00	N	2	C	9963	9000	15.03	11.93	8.36	5.56	-0.25833	24.41916	41.74	25.94	-5.47	-30.54
245500	9	NB	23	M	3.00	N	2	C	N/A	9000	N/A	N/A	N/A	N/A			#VALUE!	#VALUE!	#VALUE!	#VALUE!
245500	10	NB	23	M	3.00	N	2	C	9632	9000	11.19	9.26	6.48	4.60	-0.16083	25.34584	56.63	42.51	18.25	-8.00

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
246500	1	NB	26	-	7.50	-	-	-	8380	9000	25.30	17.83	10.44	6.05	-0.62291	20.83956	0	0	0	0
246500	2	NB	26	PO	7.50	N	6	C	8438	9000	4.03	3.72	3.20	2.72	-0.02578	30.65079	84.07	79.12	69.35	55.02
246500	3	NB	26	PO	7.50	N	6	C	11094	9000	3.82	3.50	2.60	2.60	-0.02704	29.22293	84.90	80.39	75.13	56.93
246500	4	NB	26	PO	7.50	N	6	C	9804	9000	3.69	3.36	2.94	2.49	-0.02754	30.52239	85.42	81.15	71.86	58.86
246500	5	NB	26	PO	7.50	N	6	C	8062	9000	4.86	4.24	3.57	2.92	-0.05117	28.92414	80.81	76.21	65.78	51.63
246500	6	NB	26	PO	7.50	N	6	C	9442	9000	5.14	4.52	3.81	3.22	-0.05167	29.20623	79.69	74.65	63.50	46.75
246500	7	NB	26	PO	7.50	N	6	C	9228	9000	5.37	5.19	4.88	4.52	-0.01500	33.55307	78.78	70.89	53.25	25.25
246500	8	NB	26	PO	7.50	N	6	C	9810	9000	6.39	5.78	4.91	4.07	-0.05083	29.89671	74.75	67.58	52.97	32.69
246500	9	NB	26	PO	7.50	N	6	C	9075	9000	4.09	3.79	3.19	2.69	-0.02500	30.42543	83.84	78.74	69.44	55.51
246500	10	NB	26	PO	7.50	N	6	C	9352	9000	5.88	5.34	4.56	3.88	-0.04500	30.16327	76.76	70.05	56.32	35.83
247550	1	NB	27	-	6.25	-	-	-	9201	9000	24.65	16.07	8.72	5.18	-0.71487	19.32857	0	0	0	0
247550	2	NB	27	PO	6.25	N	12	C	9184	9000	4.94	4.30	3.60	2.81	-0.05308	28.60714	79.96	73.23	58.73	45.75
247550	3	NB	27	PO	6.25	N	12	C	11467	9000	4.55	4.09	2.92	2.83	-0.03859	28.21034	81.53	74.56	66.50	45.35
247550	4	NB	27	PO	6.25	N	12	C	9935	9000	4.55	4.05	3.44	2.80	-0.04152	29.46215	81.55	74.80	60.50	46.01
247550	5	NB	27	PO	6.25	N	12	C	8413	9000	4.31	3.84	3.33	2.78	-0.03923	29.82134	82.51	76.10	61.83	46.35
247550	6	NB	27	PO	6.25	N	12	C	10078	9000	7.69	4.51	3.75	2.82	-0.26500	21.08973	68.80	71.94	56.97	45.60
247550	7	NB	27	PO	6.25	N	12	C	9064	9000	8.65	6.01	5.48	4.87	-0.22000	25.31792	64.91	62.60	37.12	6.06
247550	8	NB	27	PO	6.25	N	12	C	10007	9000	8.95	6.08	4.80	3.54	-0.23917	22.96089	63.69	62.17	44.92	31.72
247550	9	NB	27	PO	6.25	N	12	C	9656	9000	7.23	4.32	3.41	2.73	-0.24250	21.09544	70.67	73.12	60.87	47.34
247550	10	NB	27	PO	6.25	N	12	C	9320	9000	8.76	5.55	4.47	3.72	-0.26750	22.27397	64.46	65.47	48.71	28.24
248500	1	NB	29	-	5.25	-	-	-	8599	9000	19.77	14.54	8.39	5.12	-0.43610	21.47168	0	0	0	0
248500	2	NB	29	PO	5.25	N	4	C	9130	9000	4.77	3.95	3.30	2.55	-0.06818	27.45868	75.87	72.81	60.66	50.12
248500	3	NB	29	PO	5.25	N	4	C	11225	9000	4.79	4.15	2.91	2.69	-0.05345	27.05528	75.79	71.49	65.33	47.52
248500	4	NB	29	PO	5.25	N	4	C	9497	9000	5.15	4.46	3.65	2.87	-0.05686	28.26519	73.97	69.30	56.53	43.90
248500	5	NB	29	PO	5.25	N	4	C	8172	9000	5.17	4.54	3.76	2.98	-0.05231	28.73348	73.87	68.79	55.26	41.69
248500	6	NB	29	PO	5.25	N	4	C	9322	9000	5.58	5.20	4.16	3.02	-0.03167	29.37634	71.78	64.23	50.44	40.99
248500	7	NB	29	PO	5.25	N	4	C	9151	9000	6.98	6.76	6.06	5.47	-0.01833	32.74212	64.70	53.50	27.81	-6.88
248500	8	NB	29	PO	5.25	N	4	C	9974	9000	7.67	6.72	5.39	3.96	-0.07917	28.04433	61.21	53.78	35.79	22.63
248500	9	NB	29	PO	5.25	N	4	C	8910	9000	4.81	4.28	3.42	2.67	-0.04417	28.54054	75.67	70.56	59.26	47.83
248500	10	NB	29	PO	5.25	N	4	C	9416	9000	6.75	5.90	4.73	3.84	-0.07083	28.31111	65.86	59.42	43.65	24.97
249450	1	NB	31	-	8.90	-	-	-	8752	9000	22.58	15.59	8.71	4.78	-0.58272	20.18306	0	0	0	0
249450	2	NB	31	PO	8.90	N	15 ND	C	9009	9000	2.17	1.96	1.79	1.57	-0.01748	31.07834	90.40	87.44	79.47	67.20
249450	3	NB	31	PO	8.90	N	15 ND	C	10644	9000	2.83	2.58	2.27	1.98	-0.02114	30.75224	87.46	83.46	73.89	58.62

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
249450	4	NB	31	PO	8.90	N	15 ND	C	9869	9000	2.68	2.45	2.18	1.88	-0.01900	30.93878	88.13	84.26	74.98	60.71
249450	5	NB	31	PO	8.90	N	15 ND	C	8193	9000	2.46	2.18	1.98	1.87	-0.02380	30.80357	89.10	86.05	77.30	60.95
249450	6	NB	31	PO	8.90	N	15 ND	C	9431	9000	4.34	3.05	2.54	2.10	-0.10750	24.35945	80.78	80.44	70.84	56.08
249450	7	NB	31	PO	8.90	N	15 ND	C	9206	9000	4.88	4.22	3.88	3.44	-0.05500	30.14754	78.39	72.93	55.45	28.06
249450	8	NB	31	PO	8.90	N	15 ND	C	10117	9000	6.09	4.59	3.63	2.84	-0.12500	24.99507	73.03	70.56	58.32	40.61
249450	9	NB	31	PO	8.90	N	15 ND	C	8899	9000	4.24	3.29	2.62	2.08	-0.07917	25.66981	81.22	78.90	69.92	56.50
249450	10	NB	31	PO	8.90	N	15 ND	C	9528	9000	5.06	3.70	2.94	2.56	-0.11333	24.78261	77.59	76.27	66.25	46.46
250200	1	NB	32	-	9.80	-	-	-	8445	9000	26.44	15.07	8.63	5.49	-0.94760	18.00242	0	0	0	0
250200	2	NB	32	PO	9.80	N	15 D	C	9130	9000	2.96	2.70	2.45	2.15	-0.02136	31.28000	88.82	82.08	71.57	60.85
250200	3	NB	32	PO	9.80	N	15 D	C	11050	9000	3.18	2.97	2.64	2.32	-0.01765	31.51918	87.96	80.27	69.43	57.71
250200	4	NB	32	PO	9.80	N	15 D	C	9398	9000	3.85	3.60	3.25	2.81	-0.02075	31.71642	85.44	76.11	62.39	48.88
250200	5	NB	32	PO	9.80	N	15 D	C	8172	9000	2.89	2.59	2.41	2.08	-0.02478	31.12214	89.09	82.83	72.06	62.07
250200	6	NB	32	PO	9.80	N	15 D	C	9497	9000	4.44	3.90	3.37	2.66	-0.04500	29.24324	83.21	74.12	60.96	51.53
250200	7	NB	32	PO	9.80	N	15 D	C	9020	9000	4.95	4.56	4.30	3.85	-0.03250	32.14545	81.28	69.74	50.19	29.85
250200	8	NB	32	PO	9.80	N	15 D	C	10018	9000	5.75	4.98	4.11	3.25	-0.06417	28.36174	78.25	66.95	52.39	40.78
250200	9	NB	32	PO	9.80	N	15 D	C	9360	9000	3.96	3.66	2.97	2.42	-0.02500	29.75758	85.02	75.71	65.59	55.91
250200	10	NB	32	PO	9.80	N	15 D	C	9456	9000	4.90	4.18	3.49	3.04	-0.06000	28.50612	81.47	72.26	59.57	44.61
253400	1	NB	36	-	7.25	-	-	-	9267	9000	14.58	10.96	7.82	5.75	-0.30188	23.82012	0	0	0	0
253400	2	SB	36	PO	7.25	N	6	C	9722	9000	3.15	2.80	2.49	2.21	-0.02931	30.37059	78.41	74.48	68.15	61.52
253400	3	SB	36	PO	7.25	N	6	C	10951	9000	3.87	3.71	3.02	2.72	-0.01301	31.10828	73.45	66.09	61.32	52.69
253400	4	SB	36	PO	7.25	N	6	C	10121	9000	3.68	3.41	2.91	2.45	-0.02297	30.57971	74.75	68.91	62.81	57.31
253400	5	SB	36	PO	7.25	N	6	C	8467	9000	3.81	3.30	2.92	2.48	-0.04252	29.51397	73.90	69.92	62.61	56.92
253400	6	SB	36	PO	7.25	N	6	C	9705	9000	4.32	4.09	3.58	3.30	-0.01917	31.88889	70.37	62.67	54.21	42.60
253400	7	SB	36	PO	7.25	N	6	C	9184	9000	4.56	4.53	4.33	4.09	-0.00250	34.69737	68.72	58.65	44.62	28.86
253400	8	SB	36	PO	7.25	N	6	C	9887	9000	4.64	4.38	3.77	3.19	-0.02167	31.20259	68.17	60.02	51.78	44.52
253400	9	SB	36	PO	7.25	N	6	C	8252	9000	7.33	6.87	6.04	5.11	-0.03833	31.31787	49.72	37.29	22.74	11.12
253400	10	SB	36	PO	7.25	N	6	C	9704	9000	5.18	4.87	4.17	3.68	-0.02583	31.20463	64.47	55.55	46.66	35.99
254550	1	NB	38	-	2.75	-	-	-	8686	9000	12.33	9.81	6.72	4.71	-0.20982	24.38824	0	0	0	0
254550	2	SB	38	PO	2.75	F	2	C	8822	9000	6.39	4.88	3.82	3.05	-0.12582	25.19808	48.21	50.30	43.26	35.30
254550	3	SB	38	PO	2.75	F	2	C	10830	9000	7.25	5.88	3.91	3.47	-0.11427	25.08716	41.23	40.12	41.79	26.32
254550	4	SB	38	PO	2.75	F	2	C	9179	9000	8.42	6.92	5.33	3.90	-0.12501	26.24214	31.69	29.45	20.68	17.23
254550	5	SB	38	PO	2.75	F	2	C	8073	9000	7.12	5.77	4.58	3.53	-0.11241	26.42254	42.23	41.15	31.86	25.04
254550	6	SB	38	PO	2.75	F	2	C	9409	9000	9.05	7.52	5.81	4.37	-0.12750	26.57238				

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
254550	7	SB	38	PO	2.75	F	2	C	9140	9000	8.11	7.44	6.48	5.84	-0.05583	30.91739				
254550	8	SB	38	PO	2.75	F	2	C	9744	9000	8.39	6.70	5.16	3.96	-0.14083	25.79499				
254550	9	SB	38	PO	2.75	F	2	C	N/A	9000	N/A	N/A	N/A	N/A						
254550	10	SB	38	PO	2.75	F	2	C	9784	9000	10.45	8.44	6.35	4.68	-0.16750	25.67081				
255000	1	NB	39	-	4.20	-	-	-	8840	9000	26.24	16.55	7.37	4.24	-0.80684	17.91153	0	0	0	0
255000	2	SB	39	PO	4.20	F	4	C	9448	9000	8.26	6.42	4.18	2.89	-0.15321	23.50173	68.52	61.22	43.27	31.85
255000	3	SB	39	PO	4.20	F	4	C	10633	9000	9.84	8.10	5.35	3.79	-0.14530	24.70679	62.48	51.07	27.43	10.47
255000	4	SB	39	PO	4.20	F	4	C	9376	9000	9.79	7.69	5.55	3.80	-0.17518	24.55294	62.68	53.55	24.73	10.25
255000	5	SB	39	PO	4.20	F	4	C	7909	9000	10.24	8.26	6.07	3.99	-0.16500	25.12667	60.96	50.09	17.72	5.69
255000	6	SB	39	PO	4.20	F	4	C	9552	9000	12.11	8.78	6.21	4.15	-0.27750	22.90999				
255000	7	SB	39	PO	4.20	F	4	C	9097	9000	11.00	9.20	8.05	6.78	-0.15000	28.51636				
255000	8	SB	39	PO	4.20	F	4	C	9744	9000	11.90	8.85	6.22	4.42	-0.25417	23.42521				
255000	9	SB	39	PO	4.20	F	4	C	9349	9000	6.13	5.36	4.07	3.04	-0.06417	27.43556				
255000	10	SB	39	PO	4.20	F	4	C	9824	9000	11.89	8.96	6.13	4.40	-0.24417	23.44996				
256000	1	NB	41	-	4.60	-	-	-	8851	9000	26.16	14.59	7.44	4.39	-0.96430	17.11387	0	0	0	0
256000	2	SB	41	PO	4.60	F	4	C	9130	9000	5.23	4.45	3.61	2.79	-0.06572	27.66102	79.99	69.53	51.53	36.49
256000	3	SB	41	PO	4.60	F	4	C	11061	9000	6.02	5.26	3.68	3.24	-0.06374	27.03243	76.99	63.98	50.59	26.28
256000	4	SB	41	PO	4.60	F	4	C	9661	9000	6.50	5.52	4.47	3.44	-0.08151	27.61891	75.15	62.14	39.92	21.74
256000	5	SB	41	PO	4.60	F	4	C	8106	9000	7.17	6.30	5.03	3.89	-0.07309	28.19814	72.59	56.86	32.43	11.54
256000	6	SB	41	PO	4.60	F	4	C	9979	9000	8.64	7.75	6.00	4.53	-0.07417	28.24306				
256000	7	SB	41	PO	4.60	F	4	C	8943	9000	10.41	9.95	8.76	7.88	-0.03833	32.10951				
256000	8	SB	41	PO	4.60	F	4	C	10018	9000	8.91	7.80	6.00	4.46	-0.09250	27.58923				
256000	9	SB	41	PO	4.60	F	4	C	9075	9000	6.41	5.59	4.32	3.25	-0.06833	27.59438				
256000	10	SB	41	PO	4.60	F	4	C	9808	9000	8.19	7.41	5.54	4.52	-0.06500	28.28571				
256500	1	NB	42	-	4.00	-	-	-	8489	9000	29.46	19.44	9.47	5.34	-0.83490	18.86362	0	0	0	0
256500	2	SB	42	PO	4.00	F	2	C	8921	9000	6.48	5.35	4.15	3.22	-0.09416	26.57009	78.02	72.50	56.20	39.77
256500	3	SB	42	PO	4.00	F	2	C	11039	9000	6.87	6.07	4.35	3.79	-0.06658	27.51601	76.67	68.76	54.01	29.05
256500	4	SB	42	PO	4.00	F	2	C	9486	9000	7.15	6.35	5.07	3.85	-0.06720	28.37666	75.72	67.36	46.49	27.91
256500	5	SB	42	PO	4.00	F	2	C	7952	9000	7.12	6.09	4.84	3.77	-0.08583	27.60572	75.84	68.68	48.84	29.47
256500	6	SB	42	PO	4.00	F	2	C	10220	9000	13.59	12.44	9.92	7.51	-0.09583	29.05960				
256500	7	SB	42	PO	4.00	F	2	C	9195	9000	7.45	7.19	6.56	5.93	-0.02167	32.92349				
256500	8	SB	42	PO	4.00	F	2	C	9503	9000	8.02	7.11	5.66	4.12	-0.07583	28.18953				
256500	9	SB	42	PO	4.00	F	2	C	9634	9000	10.13	8.42	5.82	3.92	-0.14250	25.19052				

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
256500	10	SB	42	PO	4.00	F	2	C	9808	9000	8.68	7.58	5.84	4.48	-0.09167	27.64977				
257500	1	NB	43	-	4.00	-	-	-	8599	9000	29.25	17.92	9.01	4.63	-0.94459	17.99571	0	0	0	0
257500	2	SB	43	PO	4.00	F	6	C	8625	9000	8.48	6.97	5.14	3.64	-0.12609	25.71218	71.00	61.10	42.91	21.28
257500	3	SB	43	PO	4.00	F	6	C	10600	9000	10.58	8.75	5.43	3.87	-0.15283	24.27929	63.84	51.19	39.70	16.31
257500	4	SB	43	PO	4.00	F	6	C	9464	9000	10.90	8.50	5.77	3.60	-0.19970	23.70157	62.75	52.55	35.94	22.09
257500	5	SB	43	PO	4.00	F	6	C	7920	9000	10.43	8.38	5.97	3.99	-0.17140	24.79085	64.34	53.26	33.80	13.78
257500	6	SB	43	PO	4.00	F	6	C	9968	9000	11.89	9.72	6.62	4.29	-0.18083	24.65601				
257500	7	SB	43	PO	4.00	F	6	C	9086	9000	10.60	10.00	8.67	7.13	-0.05000	31.17170				
257500	8	SB	43	PO	4.00	F	6	C	9887	9000	11.93	9.65	6.70	4.68	-0.19000	24.79966				
257500	9	SB	43	PO	4.00	F	6	C	9360	9000	5.43	4.82	3.95	3.21	-0.05083	28.92818				
257500	10	SB	43	PO	4.00	F	6	C	9928	9000	11.89	9.47	6.39	4.56	-0.20167	24.30782				
259000	1	NB	46	-	6.50	-	-	-	8621	9000	28.02	19.87	11.19	6.54	-0.67945	20.70045	0	0	0	0
259000	2	SB	46	CIPR	6.50	F	6	C	9327	9000	4.96	4.25	3.40	2.71	-0.05950	27.77043	82.30	78.63	69.65	58.51
259000	3	SB	46	CIPR	6.50	F	6	C	11906	9000	4.87	4.38	3.23	3.03	-0.04095	28.48137	82.63	77.97	71.16	53.62
259000	4	SB	46	CIPR	6.50	F	6	C	10012	9000	5.62	4.91	4.12	3.27	-0.05918	28.77120	79.95	75.29	63.21	49.93
259000	5	SB	46	CIPR	6.50	F	6	C	8588	9000	5.12	4.43	3.53	2.88	-0.05764	28.02454	81.71	77.69	68.44	55.90
259000	6	SB	46	CIPR	6.50	F	6	C	9694	9000	6.41	5.70	4.66	3.95	-0.05917	29.09204				
259000	7	SB	46	CIPR	6.50	F	6	C	9162	9000	6.48	6.17	5.70	5.30	-0.02583	32.88889				
259000	8	SB	46	CIPR	6.50	F	6	C	10139	9000	6.98	6.34	5.28	4.17	-0.05333	29.56160				
259000	9	SB	46	CIPR	6.50	F	6	C	8614	9000	9.98	8.23	5.49	3.75	-0.14583	24.75150				
259000	10	SB	46	CIPR	6.50	F	6	C	9920	9000	7.78	7.02	5.88	4.76	-0.06333	29.56812				
259600	1	NB	48	-	4.80	-	-	-	9146	9000	19.31	14.16	9.03	5.91	-0.42888	22.25382	0	0	0	0
259600	2	SB	48	CIPR	4.80	F	6	C	9217	9000	6.43	5.22	3.91	2.98	-0.10009	25.83283	66.72	63.11	56.76	49.64
259600	3	SB	48	CIPR	4.80	F	6	C	11105	9000	7.15	5.89	4.04	3.30	-0.10468	25.44898	62.98	58.39	55.23	44.23
259600	4	SB	48	CIPR	4.80	F	6	C	9672	9000	7.79	6.20	4.69	3.48	-0.13260	25.45520	59.66	56.23	48.08	41.15
259600	5	SB	48	CIPR	4.80	F	6	C	8643	9000	7.67	6.03	4.27	3.08	-0.13711	24.51289	60.25	57.42	52.74	47.88
259600	6	SB	48	CIPR	4.80	F	6	C	10395	9000	8.60	7.28	5.20	3.49	-0.11000	25.84884				
259600	7	SB	48	CIPR	4.80	F	6	C	9744	9000	8.60	8.09	7.18	6.32	-0.04250	31.71628				
259600	8	SB	48	CIPR	4.80	F	6	C	9952	9000	11.96	10.12	7.08	4.85	-0.15333	25.69064				
259600	9	SB	48	CIPR	4.80	F	6	C	8844	9000	6.26	5.63	4.53	3.46	-0.05250	28.79233				
259600	10	SB	48	CIPR	4.80	F	6	C	9984	9000	11.07	9.26	6.43	4.56	-0.15083	25.47967				
260550	1	NB	49	-	5.00	-	-	-	8106	9000	26.99	17.25	9.62	5.30	-0.81144	19.12299	0	0	0	0
260550	2	SB	49	CIPR	5.00	F	2	C	9678	9000	4.83	4.01	3.14	2.46	-0.06820	26.84393	82.12	76.77	67.31	53.47

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
260550	3	SB	49	CIPR	5.00	F	2	C	11587	9000	5.37	4.68	3.19	2.85	-0.05761	26.76590	80.09	72.85	66.80	46.18
260550	4	SB	49	CIPR	5.00	F	2	C	9924	9000	5.95	5.19	4.12	3.09	-0.06348	27.88720	77.96	69.93	57.18	41.61
260550	5	SB	49	CIPR	5.00	F	2	C	8413	9000	5.95	5.06	3.86	2.90	-0.07399	26.92446	77.96	70.67	59.84	45.26
260550	6	SB	49	CIPR	5.00	F	2	C	10034	9000	6.86	5.77	4.38	3.37	-0.09083	26.70262				
260550	7	SB	49	CIPR	5.00	F	2	C	9162	9000	6.83	6.53	5.93	5.37	-0.02500	32.60908				
260550	8	SB	49	CIPR	5.00	F	2	C	9898	9000	7.56	6.83	5.42	4.12	-0.06083	28.71429				
260550	9	SB	49	CIPR	5.00	F	2	C	9206	9000	6.97	6.39	4.85	3.67	-0.04833	28.51076				
260550	10	SB	49	CIPR	5.00	F	2	C	9888	9000	7.86	6.80	5.28	4.08	-0.08833	27.55725				
261000	1	NB	50	-	4.90	-	-	-	8862	9000	33.67	18.71	9.03	5.19	-1.24661	16.81086	0	0	0	0
261000	2	SB	50	CIPR	4.90	F	4	C	9448	9000	4.98	4.15	3.27	2.61	-0.06906	27.01721	85.20	77.80	63.81	49.71
261000	3	SB	50	CIPR	4.90	F	4	C	12147	9000	5.22	4.42	3.11	2.71	-0.06607	26.45455	84.51	76.35	65.53	47.75
261000	4	SB	50	CIPR	4.90	F	4	C	10242	9000	6.04	4.98	3.84	2.88	-0.08787	26.40175	82.07	73.37	57.47	44.46
261000	5	SB	50	CIPR	4.90	F	4	C	8599	9000	6.51	5.39	4.16	3.13	-0.09332	26.47910	80.66	71.19	53.98	39.70
261000	6	SB	50	CIPR	4.90	F	4	C	10319	9000	7.17	6.49	5.07	3.80	-0.05667	28.52720				
261000	7	SB	50	CIPR	4.90	F	4	C	9173	9000	6.61	6.23	5.72	4.98	-0.03167	32.21483				
261000	8	SB	50	CIPR	4.90	F	4	C	9985	9000	8.22	7.26	5.66	4.04	-0.08000	27.81022				
261000	9	SB	50	CIPR	4.90	F	4	C	8745	9000	12.71	9.89	6.83	4.59	-0.23500	23.95279				
261000	10	SB	50	CIPR	4.90	F	4	C	9960	9000	8.48	7.41	5.67	4.16	-0.08917	27.45283				
262000	1	NB	52	-	3.00	-	-	-	7788	9000	27.72	17.82	10.23	6.22	-0.82531	19.48562	0	0	0	0
262000	2	NB	52	CIPR	3.00	F	2	C	9250	9000	9.87	7.18	4.93	3.59	-0.22378	22.91716	64.41	59.70	51.77	42.25
262000	3	NB	52	CIPR	3.00	F	2	C	11291	9000	10.91	8.65	5.63	4.12	-0.18865	23.96494	60.64	51.47	44.98	33.72
262000	4	NB	52	CIPR	3.00	F	2	C	9617	9000	12.24	9.10	6.24	4.16	-0.26204	23.07339	55.85	48.95	38.97	33.17
262000	5	NB	52	CIPR	3.00	F	2	C	8336	9000	11.64	9.08	6.42	4.35	-0.21323	24.22820	58.02	49.05	37.19	30.02
262000	6	NB	52	CIPR	3.00	F	2	C	9716	9000	13.15	10.19	6.91	4.64	-0.24667	23.72167				
262000	7	NB	52	CIPR	3.00	F	2	C	9020	9000	14.28	12.98	11.10	9.02	-0.10833	30.02521				
262000	8	NB	52	CIPR	3.00	F	2	C	9974	9000	17.73	14.21	9.63	5.80	-0.29333	24.09814				
262000	9	NB	52	CIPR	3.00	F	2	C	N/A	9000	N/A	N/A	N/A	N/A						
262000	10	NB	52	CIPR	3.00	F	2	C	9576	9000	10.16	7.45	5.15	3.72	-0.22583	23.07874				
263000	1	NB	53	-	2.80	-	-	-	8719	9000	14.47	10.56	6.91	4.72	-0.32601	22.43795	0	0	0	0
263000	2	NB	53	CIPR	2.80	F	4	C	9887	9000	7.22	5.32	3.58	2.49	-0.15854	22.85750	50.12	49.66	48.20	47.13
263000	3	NB	53	CIPR	2.80	F	4	C	11555	9000	10.36	7.60	4.39	3.17	-0.22977	21.72180	28.42	28.01	36.50	32.80
263000	4	NB	53	CIPR	2.80	F	4	C	10067	9000	11.24	7.90	5.02	3.28	-0.27789	21.55609	22.35	25.16	27.24	30.45
263000	5	NB	53	CIPR	2.80	F	4	C	8686	9000	10.55	7.86	5.34	3.51	-0.22364	23.01572	27.11	25.52	22.73	25.54

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara- tion	PCC Thickness (in)	Synthetic Fiber Rein- forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
263000	6	NB	53	CIPR	2.80	F	4	C	10143	9000	13.42	10.55	6.67	4.22	-0.23917	23.28465				
263000	7	NB	53	CIPR	2.80	F	4	C	9075	9000	14.15	13.13	10.54	8.22	-0.08500	29.55901				
263000	8	NB	53	CIPR	2.80	F	4	C	10358	9000	19.03	13.50	7.89	4.73	-0.46083	20.97951				
263000	9	NB	53	CIPR	2.80	F	4	C	N/A	9000	N/A	N/A	N/A	N/A						
263000	10	NB	53	CIPR	2.80	F	4	C	9872	9000	10.86	8.70	5.88	4.20	-0.18000	24.43094				
263550	1	NB	55	-	7.00	-	-	-	8281	9000	16.45	12.53	8.73	5.48	-0.32695	23.50066	0	0	0	0
263550	2	NB	55	CIPR	7.00	N	6	C	9020	9000	3.62	3.15	2.71	2.26	-0.03908	29.19008	77.99	74.84	68.90	58.65
263550	3	NB	55	CIPR	7.00	N	6	C	10984	9000	4.06	3.59	2.61	2.54	-0.03892	28.10909	75.35	71.36	70.05	53.63
263550	4	NB	55	CIPR	7.00	N	6	C	10023	9000	3.53	3.19	2.73	2.24	-0.02843	29.92366	78.55	74.56	68.72	59.18
263550	5	NB	55	CIPR	7.00	N	6	C	8413	9000	3.54	3.27	2.88	2.59	-0.02229	31.23263	78.48	73.88	67.03	52.74
263550	6	NB	55	CIPR	7.00	N	6	C	9333	9000	6.17	3.98	3.19	2.69	-0.18250	22.56078				
263550	7	NB	55	CIPR	7.00	N	6	C	9108	9000	6.58	4.34	3.87	3.70	-0.18667	24.34650				
263550	8	NB	55	CIPR	7.00	N	6	C	10183	9000	6.98	4.03	3.48	2.70	-0.24583	21.23209				
263550	9	NB	55	CIPR	7.00	N	6	C	8932	9000	5.82	3.20	2.65	2.16	-0.21833	20.28866				
263550	10	NB	55	CIPR	7.00	N	6	C	9808	9000	6.42	4.44	3.62	3.00	-0.16500	23.86916				
265000	1	NB	56	-	6.00	-	-	-	8708	9000	26.18	17.37	10.18	6.08	-0.73381	20.02290	0	0	0	0
265000	2	NB	56	CIPR	6.00	N	12	C	9546	9000	4.12	3.59	3.01	2.44	-0.04400	28.77803	84.26	79.32	70.46	59.82
265000	3	NB	56	CIPR	6.00	N	12	C	10984	9000	5.22	4.74	3.48	3.33	-0.04029	28.71900	80.06	72.74	65.79	45.26
265000	4	NB	56	CIPR	6.00	N	12	C	9826	9000	5.11	4.55	3.85	3.03	-0.04656	29.27957	80.48	73.80	62.21	50.11
265000	5	NB	56	CIPR	6.00	N	12	C	8237	9000	4.64	4.12	3.49	2.90	-0.04371	29.39294	82.26	76.29	65.76	52.35
265000	6	NB	56	CIPR	6.00	N	12	C	9869	9000	9.88	4.93	4.04	3.28	-0.41250	18.88664				
265000	7	NB	56	CIPR	6.00	N	12	C	8954	9000	10.60	5.41	5.00	4.48	-0.43250	20.32075				
265000	8	NB	56	CIPR	6.00	N	12	C	10007	9000	10.20	5.92	4.61	3.44	-0.35667	20.41176				
265000	9	NB	56	CIPR	6.00	N	12	C	8932	9000	9.63	4.05	3.28	2.75	-0.46500	16.84735				
265000	10	NB	56	CIPR	6.00	N	12	C	9816	9000	11.36	5.12	4.17	3.40	-0.52000	17.60915				
265950	1	NB	58	-	4.75	-	-	-	8292	9000	26.86	18.23	10.19	6.01	-0.71907	20.04121	0	0	0	0
265950	2	NB	58	CIPR	4.75	N	6	C	9217	9000	6.40	5.54	4.32	3.36	-0.07161	27.63664	76.19	69.64	57.65	44.14
265950	3	NB	58	CIPR	4.75	N	6	C	10534	9000	7.77	6.82	4.79	4.18	-0.07903	27.16832	71.09	62.61	52.97	30.52
265950	4	NB	58	CIPR	4.75	N	6	C	9628	9000	7.73	6.76	5.37	3.94	-0.08101	27.88150	71.22	62.94	47.35	34.40
265950	5	NB	58	CIPR	4.75	N	6	C	8226	9000	8.09	6.99	5.31	3.77	-0.09117	27.05277	69.90	61.66	47.93	37.23
265950	6	NB	58	CIPR	4.75	N	6	C	9322	9000	10.61	8.58	6.34	4.54	-0.16917	25.44204				
265950	7	NB	58	CIPR	4.75	N	6	C	9086	9000	10.65	9.33	8.29	7.22	-0.11000	29.92113				
265950	8	NB	58	CIPR	4.75	N	6	C	9667	9000	11.26	9.58	7.28	5.26	-0.14000	26.77087				

Station Post UTW	Testing Period	Lane	Section Number	Surface Prepara-tion	PCC Thickness (in)	Synthetic Fiber Rein-forcement	Joint Spacing (ftxft)	FWD Test Location	FWD Load (lbs.)	FWD Norm. Load (lbs)	D0 Norm. 0	D1 Norm. 12	D2 Norm. 24	D3 Norm. 36	Slope between D0 and D1	AREA (in.)	% Reduction In D0 Norm. 0	% Reduction In D1 Norm. 12	% Reduction In D2 Norm. 24	% Reduction In D3 Norm. 36
265950	9	NB	58	CIPR	4.75	N	6	C	8647	9000	9.31	7.50	5.55	3.95	-0.15083	25.36627				
265950	10	NB	58	CIPR	4.75	N	6	C	9768	9000	11.31	9.34	6.82	5.00	-0.16417	25.79841				
268550	1	NB	60	-	8.00	-	-	-	8051	9000	40.33	29.14	14.42	6.99	-0.93249	20.00055	0	0	0	0
268550	2	NB	60	CIPR	8.00	N	12	C	8822	9000	4.02	3.57	3.11	2.60	-0.03741	29.83249	90.03	87.75	78.42	62.77
268550	3	NB	60	CIPR	8.00	N	12	C	10732	9000	4.91	4.51	3.44	3.33	-0.03285	29.51795	87.84	84.52	76.16	52.35
268550	4	NB	60	CIPR	8.00	N	12	C	9212	9000	5.23	4.78	4.18	3.45	-0.03745	30.52710	87.04	83.61	71.00	50.64
268550	5	NB	60	CIPR	8.00	N	12	C	8949	9000	4.31	3.86	3.37	2.87	-0.03771	30.09790	89.30	86.75	76.64	58.98
268550	6	NB	60	CIPR	8.00	N	12	C	9858	9000	7.88	6.24	4.98	3.99	-0.13667	26.12437				
268550	7	NB	60	CIPR	8.00	N	12	C	9086	9000	8.80	6.55	6.17	5.52	-0.18750	27.10909				
268550	8	NB	60	CIPR	8.00	N	12	C	9832	9000	8.95	7.02	5.70	4.57	-0.16083	26.11844				
268550	9	NB	60	CIPR	8.00	N	12	C	8778	9000	7.90	4.88	4.04	3.26	-0.25167	22.02532				
268550	10	NB	60	CIPR	8.00	N	12	C	9720	9000	8.80	6.42	5.03	4.32	-0.19833	24.55909				
269450	1	NB	62	-	5.00	-	-	-	8445	9000	14.04	9.95	7.26	5.37	-0.34014	23.01139	0	0	0	0
269450	2	NB	62	CIPR	5.00	N	4	C	8339	9000	6.19	5.26	4.13	3.05	-0.07825	27.14634	55.86	47.20	43.04	43.14
269450	3	NB	62	CIPR	5.00	N	4	C	10808	9000	6.01	5.35	3.93	3.37	-0.05551	27.88089	57.16	46.29	45.84	37.21
269450	4	NB	62	CIPR	5.00	N	4	C	9267	9000	6.99	5.82	4.55	3.48	-0.09793	26.76667	50.18	41.56	37.37	35.27
269450	5	NB	62	CIPR	5.00	N	4	C	7810	9000	6.66	5.89	4.67	3.55	-0.06434	28.21453	52.54	40.84	35.69	33.92
269450	6	NB	62	CIPR	5.00	N	4	C	9409	9000	7.21	6.11	4.89	3.69	-0.09167	27.37864				
269450	7	NB	62	CIPR	5.00	N	4	C	9075	9000	7.20	6.77	6.21	5.47	-0.03583	32.19167				
269450	8	NB	62	CIPR	5.00	N	4	C	9832	9000	9.00	8.02	6.22	4.51	-0.08167	27.99333				
269450	9	NB	62	CIPR	5.00	N	4	C	N/A	9000	N/A	N/A	N/A	N/A						
269450	10	NB	62	CIPR	5.00	N	4	C	9960	9000	6.46	5.73	4.60	3.72	-0.06083	28.64396				

Table A.6 Falling Weight Deflectometer analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	3 INCH
0	22.71	10.12	11.09	11.50	12.51	14.19	15.34	17.69	19.07	12.93	
12	15.24	7.82	8.57	8.72	9.54	10.53	12.46	13.16	15.07	9.95	
24	8.76	5.15	5.26	5.94	6.43	7.14	10.56	8.39	9.67	6.58	
36	5.26	3.53	3.95	3.94	4.25	4.75	8.64	5.24	5.66	4.56	
0	26.4	6.93	8.16	8.40	8.39	11.03	8.79	9.76	6.79	10.08	4 INCH
12	17.13	5.66	6.90	6.85	6.93	9.17	8.08	7.98	5.87	8.24	
24	8.62	4.16	4.62	5.08	5.21	6.81	7.22	5.89	4.39	5.87	
36	4.91	3.06	3.62	3.56	3.72	4.85	6.22	4.24	3.24	4.37	
0	26.34	6.04	6.46	6.87	7.07	8.48	8.45	9.87	8.16	9.26	5 INCH
12	16.66	4.99	5.63	5.81	6.04	7.34	7.94	8.61	6.91	7.88	
24	9.08	3.92	3.88	4.57	4.67	5.56	7.1	6.47	5.16	5.87	
36	5.46	2.99	3.35	3.40	3.50	4.07	6.27	4.65	3.75	4.43	
0	26.93	4.93	4.98	5.21	4.97	7.94	8.73	9.95	8.88	9.66	6 INCH
12	17.80	4.2	4.46	4.62	4.37	5.12	5.98	6.52	5.55	5.94	
24	9.78	3.43	3.25	3.84	3.60	4.18	5.46	5.13	4.12	4.8	
36	5.6	2.72	3.07	3.01	2.94	3.32	4.92	3.81	3.08	3.87	
0	22.41	3.92	4.63	4.49	4.74	6.79	6.76	8.36	6.64	7.59	7 INCH
12	15.75	3.54	4.21	3.95	4.21	5.29	5.25	6.01	4.92	5.57	
24	9.33	3.10	3.14	3.37	3.62	4.30	4.86	4.95	4.04	4.53	
36	5.63	2.45	2.93	2.77	3.02	3.47	4.55	3.9	3.26	3.71	
0	26.45	3.14	3.48	3.7	3.17	5.43	6.24	6.68	4.89	6.09	8 INCH
12	17.72	2.78	3.21	3.38	2.86	4.22	5.51	5.52	3.86	4.63	
24	9.82	2.44	2.57	2.97	2.56	3.48	5.1	4.39	3.07	3.65	
36	5.63	2.07	2.41	2.49	2.22	2.77	4.49	3.45	2.45	3.14	

Average Slope Between D0 and D1						
	3 Inch	4 Inch	5 Inch	6 Inch	7 Inch	8 Inch
Pre-UTW	-0.62	-0.77	-0.81	-0.76	-0.56	-0.73
Post-UTW	-0.19	-0.10	-0.09	-0.06	-0.03	-0.03
1 Year	-0.21	-0.10	-0.07	-0.04	-0.04	-0.02
2 Year	-0.23	-0.13	-0.09	-0.05	-0.04	-0.03
3 Year	-0.25	-0.12	-0.09	-0.05	-0.04	-0.03
5 Year	-0.31	-0.16	-0.09	-0.23	-0.12	-0.1
6 Year	-0.24	-0.06	-0.04	-0.23	-0.13	-0.06
7 year	-0.38	-0.15	-0.1	-0.29	-0.2	-0.1
8 Year	-0.33	-0.08	-0.1	-0.28	-0.14	-0.09
10 Year	-0.25	-0.15	-0.12	-0.31	-0.17	-0.12

Table A.6 (continued)

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	54.67	49.04	41.65	32.62	3 INCH
1 Year	48.47	42.49	39.60	24.20	
2 Year	45.71	40.72	31.23	24.45	
3 Year	43.52	37.13	26.77	18.99	
5 Year	34.43	28.42	17.29	8.55	
6 Year	30.72	16.2	-20.43	-64.08	
7 year	19.2	12.41	3.96	-0.46	
8 Year	26.58	19.01	11.31	10.62	
10 Year	38.81	32.21	23.24	11.53	
Post-UTW	73.92	67.01	51.38	36.71	4 INCH
1 Year	69.25	59.73	45.63	24.99	
2 Year	68.30	60.03	40.41	26.24	
3 Year	68.31	59.49	38.62	22.80	
5 Year	58.86	47.37	21.31	1.38	
6 Year	66.75	52.75	15.09	-29.43	
7 year	62.96	53.26	30.97	12.2	
8 Year	74.31	65.98	49.13	33.56	
10 Year	61.63	51.64	31.22	9.81	
Post-UTW	75.13	68.56	56.48	45.05	5 INCH
1 Year	73.52	64.78	56.91	38.67	
2 Year	71.59	63.45	49.16	37.44	
3 Year	70.94	61.98	47.98	35.30	
5 Year	65.89	54.65	38.45	25.06	
6 Year	65.5	50.23	20.7	-15.99	
7 year	59.69	46.37	28.28	14.62	
8 Year	70.79	60.68	44.65	31.18	
10 Year	63.01	51.58	35.3	18.51	
Post-UTW	81.68	76.30	64.44	50.19	6 INCH
1 Year	81.47	74.82	66.56	44.19	
2 Year	80.68	74.06	60.51	45.5	
3 Year	81.58	75.41	62.72	46.25	
5 Year	70.31	71.24	57.08	40.32	
6 Year	67.37	66.28	43.67	10.53	
7 year	63.13	63.26	47.02	30.55	
8 Year	67.05	69.27	58.07	44.29	
10 Year	64.02	66.68	50.83	30.26	

Table A.6 (continued)

Post-UTW	81.97	77.68	66.35	56.03	7 INCH
1 Year	78.56	73.66	65.99	47.59	
2 Year	79.38	75.31	63.6	50.37	
3 Year	78.31	73.49	61.00	45.79	
5 Year	69.41	65.98	53.51	37.7	
6 Year	69.3	65.76	47.38	18.41	
7 year	62.89	61.37	46.62	30.1	
8 Year	69	66.97	55.46	41.71	
10 Year	65.8	63.72	51.02	33.63	
Post-UTW	87.78	83.62	74.81	63.34	8 INCH
1 Year	86.55	81.3	73.39	57.25	
2 Year	85.74	80.34	69.3	55.74	
3 Year	87.66	83.19	73.35	60.27	
5 Year	78.84	75.64	64.29	51.14	
6 Year	75.79	67.07	46.74	20.08	
7 year	73.79	67.34	54.29	38.57	
8 Year	81.37	77.18	68	56.35	
10 Year	76.39	73.03	62.45	44.52	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
3 INCH	15.86	16.83	18.41	21.09
4 INCH	12.29	15.37	20.16	26.9
5 INCH	12.12	16.98	21.18	26.54
6 INCH	17.66	9.62	13.61	19.93
7 INCH	16.17	13.96	15.33	22.4
8 INCH	11.39	10.59	12.36	18.82

Table A.7 Falling Weight Deflectometer joint spacing 3″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	23.95	10.84	10.85	11.45	12.45	13.95	15.33	17.08	N/A	11.45	3 Inch 2 X 2
12	15.57	8.11	8.42	8.65	9.48	9.87	11.58	12.51	N/A	8.78	
24	8.69	5.16	5.22	5.92	6.3	6.82	9.93	8.02	N/A	6.05	
36	5.12	3.60	3.96	3.94	4.16	4.64	8.11	5.06	N/A	4.4	
0	20.22	8.67	11.59	11.61	12.61	14.68	15.35	18.91	19.07	15.9	3 Inch 4 X 4
12	14.58	7.25	8.87	8.86	9.66	11.84	14.23	14.47	15.07	12.3	
24	8.90	5.13	5.35	5.99	6.68	7.78	11.81	9.14	9.67	7.63	
36	5.52	3.38	3.95	3.95	4.43	4.97	9.69	5.58	5.66	4.88	

Average Slope between D0 and D1		
	2 X 2	4 X 4
Pre-UTW	-0.70	-0.47
Post-UTW	-0.23	-0.12
1 Year	-0.20	-0.23
2 Year	-0.23	-0.23
3 Year	-0.25	-0.25
5 Year	-0.34	-0.24
6 Year	-0.31	-0.09
7 year	-0.38	-0.37
8 Year	N/A	-0.33
10 Year	-0.22	-0.3

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	54.21	48.5	40.76	28.96	3 Inch 2 X 2
1 Year	52.93	45.35	39.78	21.75	
2 Year	49.51	42.97	30.98	22.32	
3 Year	47.63	39.72	27.87	18.22	
5 Year	40.15	35.25	20.46	7.78	
6 Year	36.44	25.98	-12.51	-58.5	
7 year	29.75	21.32	8.3	-0.23	
8 Year	N/A	N/A	N/A	N/A	
10 Year	47.12	40.26	27.63	11.5	
Post-UTW	55.58	50.13	43.42	39.93	3 Inch 4 X 4
1 Year	39.54	36.77	39.26	29.09	
2 Year	38.11	36.22	31.73	28.71	
3 Year	35.31	31.96	24.58	20.54	
5 Year	22.97	14.76	10.94	10.11	
6 Year	19.27	-3.37	-36.25	-75.25	
7 year	-1.92	-5.41	-4.73	-0.91	
8 Year	26.58	19.01	11.31	10.62	
10 Year	22.17	16.11	14.46	11.58	

Table A.7 (continued)

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
2 X 2	24.46	27.18	32.46	29.19
4 X 4	33.41	34.02	28.96	28.35

Table A.8 Falling Weight Deflectometer joint spacing 5″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	28.17	6.51	7.01	6.89	7.71	8.97	8.15	9.15	7.75	9.55	5 Inch 2 X 2
12	17.7	5.14	6.33	5.98	6.55	7.75	7.8	8.09	6.81	8.05	
24	9.75	3.96	4.15	4.76	4.87	5.69	7	6.12	5.11	6.01	
36	5.69	3.03	3.51	3.44	3.53	4.34	6.21	4.52	3.77	4.52	
0	23.41	5.3	5.51	6.17	6.38	7.15	7.8	8.45	7.98	7.47	5 Inch 4 X 4
12	14.45	4.45	4.79	5.2	5.53	6.39	7.43	7.45	6.59	6.61	
24	8.03	3.58	3.41	4.13	4.40	5.03	6.69	5.82	4.86	5.14	
36	5.02	2.75	3.00	3.17	3.39	3.76	5.95	4.24	3.5	4.06	
0	29.01	6.71	7.36	7.79	7.57	9.92	9.51	12.23	8.62	11.46	5 Inch 6 X 6
12	18.91	5.64	6.27	6.52	6.39	8.35	8.71	10.5	7.31	9.44	
24	10.04	4.34	4.34	5.05	4.88	6.17	7.72	7.59	5.5	6.75	
36	5.89	3.30	3.7	3.68	3.64	4.3	6.72	5.27	3.98	4.85	

Average Slope between D0 and D1			
	2 X 2	4 X 4	6 X 6
Pre-UTW	-0.87	-0.75	-0.84
Post-UTW	-0.11	-0.07	-0.09
1 Year	-0.06	-0.06	-0.09
2 Year	-0.08	-0.08	-0.11
3 Year	-0.1	-0.07	-0.1
5 Year	-0.1	-0.06	-0.13
6 Year	-0.03	-0.03	-0.07
7 year	-0.09	-0.08	-0.14
8 Year	-0.08	-0.12	-0.11
10 Year	-0.12	-0.07	-0.17

Table A.8. (continued)

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	77.10	71.11	59.44	47.23	5 Inch 2 X 2
1 Year	75.33	64.46	57.54	38.80	
2 Year	75.64	66.32	51.28	39.68	
3 Year	72.84	63.16	50.16	38.42	
5 Year	68.42	56.48	41.81	24.67	
6 Year	71.23	56.07	28.34	-8.57	
7 year	67.72	54.46	37.36	20.71	
8 Year	72.57	61.58	47.66	33.58	
10 Year	66.31	54.66	38.49	20.76	
Post-UTW	74.23	66.83	54.76	44.86	5 Inch 4 X 4
1 Year	73.61	64.53	56.82	39.69	
2 Year	70.34	61.59	47.82	36.34	
3 Year	69.92	59.42	44.34	31.71	
5 Year	66.52	53.76	36.57	23.99	
6 Year	63.49	46	15.3	-21.02	
7 year	59.65	45.23	26.7	14.82	
8 Year	71.14	59.79	41.86	28.47	
10 Year	65.84	52.86	35.76	18.16	
Post-UTW	75.01	69.17	56.80	43.84	5 Inch 6 X 6
1 Year	72.18	65.32	56.59	37.21	
2 Year	70.56	64.01	49.53	37.42	
3 Year	71.05	64.62	51.4	38.01	
5 Year	63.37	54.61	38.7	26.76	
6 Year	64.37	51.96	22.81	-14.23	
7 year	54.38	42.5	24.34	10.28	
8 Year	69.26	60.97	45.44	32.3	
10 Year	57.06	47.81	32.56	17.48	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
2 X 2	10.79	16.45	20.95	26.47
4 X 4	8.39	13.97	19.00	26.70
6 X 6	17.95	21.36	24.24	26.36

Table A.9 Falling Weight Deflectometer joint spacing 7″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	20.17	3.72	4.11	3.84	4.15	6.06	6.17	6.87	5.91	6.72	7 Inch 6 X 6
12	14.43	3.34	3.78	3.49	3.7	4.74	4.75	5.17	4.58	4.97	
24	8.93	2.88	2.88	2.99	3.23	3.85	4.4	4.28	3.84	4.14	
36	5.52	2.44	2.65	2.49	2.77	3.2	4.15	3.43	3.17	3.5	
0	26.43	3.69	5.18	5.17	5.14	7.89	7.52	10.82	7.79	9.01	7 Inch 12 X 12
12	18.31	3.24	4.63	4.29	4.57	5.73	5.28	6.43	4.76	5.94	
24	10.41	2.80	3.37	3.71	3.85	4.62	4.83	5.17	3.78	4.71	
36	6.11	2.28	3.21	3.03	3.15	3.62	4.52	4.04	3.01	3.8	

Average Slope between D0 and D1		
	6 X 6	12 X 12
Pre-UTW	-0.48	-0.68
Post-UTW	-0.03	-0.04
1 Year	-0.03	-0.05
2 Year	-0.03	-0.07
3 Year	-0.04	-0.05
5 Year	-0.11	-0.18
6 Year	-0.12	-0.19
7 year	-0.14	-0.37
8 Year	-0.11	-0.25
10 Year	-0.15	-0.26

Table A.9 (continued)

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	80.91	77.46	67.65	55.39	7 Inch 6 X 6
1 Year	78.6	74.70	67.24	51.58	
2 Year	80.09	76.51	66.2	54.37	
3 Year	78.79	74.93	63.73	49.16	
5 Year	69.28	66.66	56.5	41.32	
6 Year	68.47	66.18	50.48	24.25	
7 year	65.42	63.97	52.03	37.51	
8 Year	67.97	65.86	55.56	42.74	
10 Year	65.92	64.6	53.31	36.35	
Post-UTW	86.07	82.40	73.23	62.37	7 Inch 12 X 12
1 Year	79.8	74.39	67.68	47.26	
2 Year	79.91	76.64	64.54	49.99	
3 Year	80.01	74.83	63.08	48.2	
5 Year	70.4	68.43	55.6	40.69	
6 Year	71.87	70.36	53.44	26	
7 year	59.45	63.7	50.15	34.06	
8 Year	71.18	73.36	63.67	50.8	
10 Year	66.07	66.67	54.65	37.81	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
6 X 6	14.99	12.86	14.34	19.04
12 X 12	19.99	15.73	18.58	24.56

Table A.10 Falling Weight Deflectometer surface preparation 3″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	21.10	8.54	10.64	11.74	11.09	13.29	14.22	18.38	N/A	10.51	3 Inch CIPR
12	14.19	6.25	8.13	8.5	8.47	10.37	13.06	13.86	N/A	8.08	
24	8.57	4.26	5.01	5.63	5.88	6.79	10.82	8.76	N/A	5.52	
36	5.47	3.04	3.65	3.72	3.93	4.43	8.62	5.27	N/A	3.96	
0	27.24	12.41	12.68	12.37	15.24	16.5	18.49	20.33	19.07	15.37	3 Inch M
12	17.75	9.85	9.76	9.46	11.50	11.63	13.74	14.85	15.07	11.7	
24	9.57	6.2	5.89	6.36	7.40	7.82	11.74	9.23	9.67	7.36	
36	5.3	4.01	4.32	4.10	4.70	5.08	9.58	5.64	5.66	4.92	

Table A.10 (continued)

Average Slope between D0 and D1		
	CIPR	Milled
Pre-UTW	-0.58	-0.79
Post-UTW	-0.19	-0.21
1 Year	-0.21	-0.24
2 Year	-0.27	-0.24
3 Year	-0.22	-0.31
5 Year	-0.24	-0.41
6 Year	-0.1	-0.4
7 year	-0.38	-0.46
8 Year	N/A	-0.33
10 Year	-0.2	-0.31

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	57.27	54.68	49.98	44.69	3 Inch CIPR
1 Year	44.53	39.74	40.74	33.26	
2 Year	39.1	37.06	33.10	31.81	
3 Year	42.57	37.29	29.96	27.78	
5 Year	29.91	21.45	17.92	17.96	
6 Year	25.36	1.41	-30.58	-59.67	
7 year	2.28	-3.79	-4.21	3.22	
8 Year	N/A	N/A	N/A	N/A	
10 Year	1.03	-0.29	-12.8	-11.38	
Post-UTW	55.09	44.87	35.55	23.68	3 Inch M
1 Year	53.51	45.12	38.12	17.46	
2 Year	54.79	46.92	33.50	21.95	
3 Year	44.6	35.69	22.95	11.12	
5 Year	40.04	34.75	18.09	2.7	
6 Year	33.12	23.39	-21.68	-80.43	
7 year	26.22	16.78	2.96	-8.4	
8 Year	26.58	19.01	11.31	10.62	
10 Year	43.09	34.49	23.13	5.77	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
CIPR	56.24	54.97	62.78	56.07
M	12.00	10.38	12.42	17.91

Table A.11 Falling Weight Deflectometer surface preparation 5″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	24.17	5.76	6.30	6.9	6.98	8.09	7.98	9.6	8.81	9.04	5 Inch CIPR
12	15.66	4.84	5.43	5.79	5.87	6.85	7.39	8.36	7.35	7.71	
24	9.03	3.75	3.81	4.51	4.45	5.18	6.67	6.33	5.44	5.56	
36	5.56	2.89	3.28	3.38	3.29	3.78	5.87	4.56	3.92	4.3	
0	35.11	7.75	7.9	7.84	8.21	10.82	9.37	12.11	9.4	11.62	5 Inch M
12	21.24	6.21	7.03	6.69	7.1	9.45	8.9	10.58	8.02	9.52	
24	10.38	4.79	4.65	5.25	5.47	6.99	7.89	7.61	5.9	6.86	
36	5.91	3.58	3.9	3.71	4.12	5.09	6.84	5.32	4.2	4.98	
0	22.97	5	5.4	5.82	6.17	7.11	8.7	8.29	5.61	7.47	5 Inch PO
12	14.56	4.2	4.7	4.99	5.42	6.48	8.36	7.26	4.94	6.66	
24	7.92	3.46	3.29	4.06	4.39	5.08	7.41	5.7	3.87	5.14	
36	4.76	2.67	2.96	3.15	3.44	3.78	6.68	4.21	2.96	4.18	

Average Slope between D0 and D1			
	CIPR	Milled	Patch Only
Pre-UTW	-0.71	-1.16	-0.7
Post-UTW	-0.08	-0.13	-0.07
1 Year	-0.07	-0.07	-0.06
2 Year	-0.09	-0.1	-0.07
3 Year	-0.09	-0.09	-0.06
5 Year	-0.1	-0.11	-0.05
6 Year	-0.05	-0.04	-0.03
7 year	-0.1	-0.13	-0.09
8 Year	-0.12	-0.12	-0.06
10 Year	-0.11	-0.18	-0.07

Table A.11 (continued)

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	73.22	66.90	57.72	48.02	5 Inch CIPR
1 Year	71.16	63.30	57.28	41.18	
2 Year	68.22	60.81	49.49	39.38	
3 Year	68.26	60.36	50.04	40.8	
5 Year	63.58	54.4	42.23	31.99	
6 Year	63.91	50.51	25.72	-5.23	
7 year	55.92	43.41	29.09	18.18	
8 Year	67.34	57.3	42.33	29.52	
10 Year	60.05	49.36	36.16	22.66	
Post-UTW	77.10	70.11	53.78	39.36	5 Inch M
1 Year	76.53	65.51	54.93	34.156	
2 Year	77.07	67.78	49.27	37.23	
3 Year	75.36	65.20	46.99	30.26	
5 Year	68.21	54.35	32.52	13.89	
6 Year	72.53	57.09	23.8	-15.75	
7 year	65.23	50	26.96	9.77	
8 Year	72.91	62	43.34	28.77	
10 Year	66.18	54.38	33.84	15.64	
Post-UTW	77.93	71.17	56.09	43.30	5 Inch PO
1 Year	76.39	67.73	57.96	36.9	
2 Year	74.56	65.72	48.23	32.82	
3 Year	73.23	62.82	43.84	26.61	
5 Year	69.38	55.56	34.92	18.39	
6 Year	62.45	42.66	5.06	-43.13	
7 year	63.58	50.16	27.59	10.55	
8 Year	75.59	66.12	50.61	36.92	
10 Year	67.28	54.32	34.61	11.04	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
CIPR	13.17	17.54	21.56	25.36
M	10.92	15.73	19.94	23.72
PO	10.65	16.85	21.48	32.26

Table A.12 Falling Weight Deflectometer surface preparation 7″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	25.14	4.15	5.17	5.14	5.24	7.98	7.71	10.13	7.32	8.91	5 Inch M
12	17.24	3.77	4.67	4.43	4.67	6.12	5.67	6.97	5.14	6.09	
24	9.57	3.33	3.43	3.76	3.99	4.88	5.23	5.62	4.09	4.84	
36	5.54	2.48	3.16	3.05	3.28	3.77	4.88	4.34	3.21	3.86	
0	19.94	3.59	3.85	3.69	4.33	4.73	4.97	5.52	5.71	5.53	5 Inch PO
12	14.39	3.26	3.61	3.38	3.77	4.31	4.86	5.08	5.33	5.11	
24	9.13	2.85	2.81	2.92	3.25	3.7	4.61	4.34	4.62	4.37	
36	5.9	2.47	2.66	2.47	2.7	3.26	4.31	3.63	3.9	3.78	

Average Slope between D0 and D1		
	Milled	Patch Only
Pre-UTW	-0.66	-0.46
Post-UTW	-0.03	-0.03
1 Year	-0.04	-0.02
2 Year	-0.06	-0.03
3 Year	-0.05	-0.05
5 Year	-0.16	-0.04
6 Year	-0.17	-0.01
7 year	-0.26	-0.04
8 Year	-0.18	-0.03
10 Year	-0.23	-0.04

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	83.34	77.85	64.52	54.25	5 Inch M
1 Year	79.05	72.61	63.86	42.47	
2 Year	79.24	74.17	60.45	44.31	
3 Year	78.75	72.63	57.9	39.81	
5 Year	68.32	64.08	48.36	30.92	
6 Year	69.4	66.35	44.53	10.58	
7 year	59.93	58.54	40.37	20.69	
8 Year	71.21	69.57	56.6	41.19	
10 Year	64.6	63.97	48.91	29.58	
Post-UTW	81.24	78.76	68.75	58.27	5 Inch PO
1 Year	79.17	76.92	68.22	54.81	
2 Year	80.08	77.95	67.33	58.08	
3 Year	77.35	75.05	64.2	54.28	
5 Year	75.03	68.66	58.86	44.67	
6 Year	73.75	64.77	48.93	27.05	
7 year	71.46	63.8	52.37	38.6	
8 Year	66.78	58.02	46.09	33.32	
10 Year	70.61	62.8	51.49	35.91	

Table A.12 (continued)

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
M	18.74	13.88	15.61	24.67
PO	10.63	15.96	17.26	22.36

Table A.13 Falling Weight Deflectometer synthetic fiber 5″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	29.39	6.16	6.59	6.99	7.29	8.82	8.53	10.14	8.53	9.81	5 Inch F
12	17.87	5.04	5.72	5.88	6.16	7.7	8.1	8.86	7.26	8.32	
24	9.31	3.92	3.89	4.6	4.71	5.77	7.23	6.56	5.39	6.11	
36	5.44	3	3.32	3.38	3.54	4.23	6.37	4.68	3.89	4.55	
0	20.22	5.79	6.19	6.62	6.64	7.8	8.28	9.31	7.06	8.17	5 Inch N
12	14.24	4.92	5.44	5.68	5.81	6.63	7.62	8.11	5.89	6.99	
24	8.61	3.92	3.88	4.52	4.58	5.13	6.85	6.3	4.49	5.38	
36	5.5	2.99	3.41	3.43	3.44	3.75	6.05	4.58	3.31	4.19	

Average Slope between D0 and D1		
	Fiber	No Fiber
Pre-UTW	-0.96	-0.5
Post-UTW	-0.09	-0.07
1 Year	-0.07	-0.06
2 Year	-0.09	-0.08
3 Year	-0.09	-0.07
5 Year	-0.09	-0.1
6 Year	-0.04	-0.05
7 year	-0.11	-0.1
8 Year	-0.11	-0.1
10 Year	-0.12	-0.1

Table A.13 (continued)

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	78.04	71.24	57.83	44.67	5 Inch F
1 Year	76.27	67.1	58.00	38.79	
2 Year	74.83	66.20	50.2	37.24	
3 Year	73.7	64.42	48.83	34.15	
5 Year	68.69	56.01	37.53	21.47	
6 Year	69.3	52.95	20.9	-19.18	
7 year	63.67	49.45	29.31	13.39	
8 Year	70.89	59.34	42.07	27.89	
10 Year	64.9	52.26	34.06	15.68	
Post-UTW	69.31	63.21	53.79	45.8	5 Inch N
1 Year	68.01	60.13	54.71	38.42	
2 Year	65.12	57.93	47.09	37.85	
3 Year	65.44	57.1	46.3	37.61	
5 Year	60.3	51.93	40.29	32.26	
6 Year	57.92	44.77	20.3	-9.6	
7 year	51.72	40.22	26.22	17.06	
8 Year	70.51	64.71	52.4	41.07	
10 Year	59.24	50.21	37.78	24.19	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
F	13.14	18.98	23.77	28.99
N	10.07	13	16.01	21.61

Table A.14 Falling Weight Deflectometer synthetic fiber 7″ PCC analysis

Average Deflection Basins											
	Pre-UTW	Post-UTW	1 Year	2 Year	3 Year	5 Year	6 Year	7 Year	8 Year	10 Year	
0	26.49	4.56	5.27	5.26	5.39	8.64	8.41	10.79	7.95	9.55	7 Inch F
12	17.73	4.13	4.77	4.72	4.82	6.38	5.7	6.94	5.21	6.04	
24	9.41	3.68	3.52	3.99	4.14	5.01	5.25	5.58	4.17	4.83	
36	5.28	2.67	3.20	3.22	3.4	3.87	4.97	4.29	3.26	3.84	
0	19.36	3.43	4.16	3.92	4.25	5.41	5.53	6.54	5.67	6.12	7 Inch N
12	14.26	3.09	3.79	3.38	3.75	4.48	4.91	5.32	4.69	5.22	
24	9.26	2.67	2.85	2.91	3.23	3.77	4.56	4.47	3.93	4.3	
36	5.9	2.28	2.72	2.43	2.73	3.17	4.23	3.61	3.26	3.62	

Table A.14 (continued)

Average Slope between D0 and D1		
	Fiber	No Fiber
Pre-UTW	-0.73	-0.42
Post-UTW	-0.04	-0.03
1 Year	-0.04	-0.03
2 Year	-0.05	-0.05
3 Year	-0.05	-0.04
5 Year	-0.19	-0.08
6 Year	-0.23	-0.05
7 year	-0.32	-0.1
8 Year	-0.23	-0.08
10 Year	-0.29	-0.07

% Reduction In Average Deflections					
	D0	D1	D2	D3	
Post-UTW	82.38	76.16	60.21	49.06	7 Inch F
1 Year	79.79	72.75	62.26	39.29	
2 Year	79.85	73.12	57.43	39.11	
3 Year	79.24	72.42	55.59	35.28	
5 Year	67.22	63.35	46.01	26.18	
6 Year	68.05	66.97	43.15	5.08	
7 year	59.44	59.69	39.39	17.82	
8 Year	70.17	69.82	54.87	37.72	
10 Year	63.83	65.17	47.97	26.77	
Post-UTW	81.67	78.83	70.96	61.25	7 Inch N
1 Year	77.63	74.35	68.79	53.82	
2 Year	79.03	76.95	68.22	58.81	
3 Year	77.62	74.31	65.06	53.68	
5 Year	71.05	67.95	59.14	46.34	
6 Year	70.25	64.85	50.54	28.41	
7 year	65.47	62.63	52.04	39.3	
8 Year	68.13	64.82	55.9	44.7	
10 Year	67.27	62.63	53.31	38.76	

% Decrease In % Reduction In Average Deflections				
	0	12	24	36
F	18.55	10.99	12.24	22.29
N	14.4	16.2	17.65	22.49

Table A.15 Influence of test variables on visual distress

Section	Corner	Longitudinal	Transverse	Diagonal	All Cracks	Panel Size	PCC Thickness	Fiber	Surface Prep
53	38	103	316		457	4x4-6x6	2	F	CIPR
10	37	78	213	3	331	2x2	2	F	Milled
23	6	45	254		305	2x2	2	N	Milled
62	15	26	218		259	4x4	2	N	CIPR
65		1	132	1	134	AC	4.5	N	CIPR
34		4	114		118	AC	4.5	-	Patch Only
39	21	15	69		105	4x4	2	F	Patch Only
16		10	76		86	AC	4.5	-	Milled
52	48	16	1	3	68	2x2	2	F	CIPR
11	14	27			41	4x4	2	M	Milled
7	14	11			25	2x2	4	F	Milled
43		5	17		22	6x6	4	F	Patch Only
22T	13	6	1		20	2x2	4 - 2	N	Milled
41		1	17		18	4x4	4	F	Patch Only
40T	6		11		17	4x4	2 - 4	F	Patch Only
51T	5	3		5	13	2x2	4 - 2	F	CIPR
38	6	2	3	1	12	2x2	2	F	Patch Only
45	4	6	2		12	12x12	6	F	Patch Only
32	4	7			11	15x12	8	N	Patch Only
1	4	4		1	9	20x12	8	N	Milled
14	3	6			9	12x12	6	M	Milled
36	1	5	3		9	6x6	6	N	Patch Only
4		8			8	6x6	6	F	Milled
29			7	1	8	4x4	6 - 2	N	Patch Only
29	3	5			8	4x4	4	N	Patch Only
48		8			8	6x6	4	F	CIPR
6	2	5			7	6x6	4	F	Milled
44T		2	5		7	6x6-12x12	4 - 6	F	Patch Only
31		5			5	15x12	8	N	Patch Only
50	2	3			5	2x2	4	F	CIPR
3	1	3			4	12x12	6	F	Milled
49	3	1			4	2x2	4	F	CIPR

Table A.15 (continued)

Section	Corner	Longitudinal	Transverse	Diagonal	All Cracks	Panel Size	PCC Thickness	Fiber	Surface Prep
60		4			4	12x12	6	N	CIPR
12T	1	3			4	4x4-6x6	2 - 6	M	Milled
9T		3	1		4	4x4	4 - 2	F	Milled
21	1	2			3	2x2	4	N	Milled
2T		3			3	12x12	8 - 6	N, F	Milled
57T	1	2			3	12x12-6x6	6 - 4	N	CIPR
61T		3			3	12x12-4x4	6 - 2	N	CIPR
13	1	1			2	6x6	6	M	Milled
58		2			2	6x6	4	N	CIPR
30T		2			2	4x4-15x12	4 - 8	N	Patch Only
37T				2	2	6x6-2x2	6 - 2	N, F	Patch Only
25		1			1	6x6	6	N	Milled
27		1			1	12x12	6	N	Patch Only
42		1			1	2x2	4	F	Patch Only
46		1			1	6x6	6	F	CIPR
55		1			1	6x6	6	N	CIPR
56		1			1	12x12	6	N	CIPR
15T	1				1	12x12-6x6	6 - 4.5	F	Milled
59T		1			1	6x6-12x12	4 - 6	N	CIPR
63T		1			1	4x4-12x12	2 - 6	N	CIPR

NOTE: “T” denotes Transition section

APPENDIX B: PAVEMENT DISTRESS CHARTS

Section #	Slab Dimension	Area of crack	SBL Number of Slabs						NBL Number of Slabs					
			1	2	3	4	5	6	1	2	3	4	5	6
1	20x12	NE	-						2					
1	20x12	NW	1											
1	20x12	SE							1					
1	20x12	SW												
3	12x12	NE												
3	12x12	NW	1											
3	12x12	SE												
3	12x12	SW												
6	6x6	NE												
6	6x6	NW	1											
6	6x6	SE												
6	6x6	SW	1											
7	2x2	NE												
7	2x2	NW												
7	2x2	SE		1						7	1		1	1
7	2x2	SW		1					2					
10	2x2	NE	1	1	2			1	2	2			1	1
10	2x2	NW	1		1	1			6					
10	2x2	SE				1			1				1	1
10	2x2	SW	2		2			1	4	3		1		
11	4x4	NE	4							2				
11	4x4	NW		1					1					
11	4x4	SE	2							3				
11	4x4	SW	1											
13	6x6	NE												
13	6x6	NW							1					
13	6x6	SE												
13	6x6	SW												
14	12x12	NE	2											
14	12x12	NW												
14	12x12	SE	1											
14	12x12	SW												
21	2x2	NE												
21	2x2	NW					1							
21	2x2	SE												
21	2x2	SW												
23	2x2	NE	2											
23	2x2	NW											1	
23	2x2	SE	1											
23	2x2	SW	1										1	
29	4x4	NE												
29	4x4	NW												
29	4x4	SE												
29	4x4	SW	1							2				
32	15x12	NE	1											
32	15x12	NW							3					
32	15x12	SE												

32	15x12	SW												
36	6x6	NE												
36	6x6	NW												
36	6x6	SE												
36	6x6	SW								1				
38	2x2	NE	1											
38	2x2	NW	1	2										
38	2x2	SE							1					
38	2x2	SW		1										
39	4x4	NE	6						1					
39	4x4	NW	4											
39	4x4	SE	5						1					
39	4x4	SW	3						1					
45	12x12	NE												
45	12x12	NW							2					
45	12x12	SE												
45	12x12	SW							2					
49	2x2	NE												
49	2x2	NW										1		
49	2x2	SE												
49	2x2	SW						1				1		
50	2x2	NE											1	
50	2x2	NW												
50	2x2	SE											1	
50	2x2	SW												
52	2x2	NE	1	3			1				1			1
52	2x2	NW		1	8			2	3	1			3	
52	2x2	SE		2							2			3
52	2x2	SW		1	4			1	5	4			1	
53	4x4	NE	8						1	3	1			
53	4x4	NW		5	2				3					
53	4x4	SE	6						1	3				
53	4x4	SW		3					2					
62	4x4	NE	4											
62	4x4	NW		6					1					
62	4x4	SE	2											
62	4x4	SW		1					1					

<u>Legend:</u>

Boxes represent number of slabs in each particular section

Each number in the box represents the number of cracks found in each slab within the section

ONLY ON CORNER CRACKS FIGURE:

Each number in the box represents the general area of the cracks in each slab within the section

Open joint cracks are listed in the notes column

Sections 16,34, & 65 are ACC and do not have slab dimensions and are divided into 3 sections per lane

Figure B.1 Corner crack locations

Section #	Slab Dimension	SBL 1	SBL 2	SBL 3	SBL 4	SBL 5	SBL 6	NBL 1	NBL 2	NBL 3	NBL 4	NBL 5	NBL 6
		SBL Number of Slabs						NBL Number of Slabs					
1	20x12							4					
3	12x12	2						1					
4	6x6	1						2	5				
6	6x6	2	1					2					
7	2x2		1			1		2	2		1	3	1
10	2x2	4	9	4	6	5	1	11	18	6	3	8	3
11	4x4	8						12	6	1			
13	6x6		1										
14	12x12	4						2					
16	AC	2	2	1				3	2				
21	2x2		1			1							
23	2x2	12	9	3	4	2		3	5	2		5	
25	6x6							1					
27	12x12							1					
29	4x4	1		2					1	1			
31	15x12							5					
32	15x12	2						5					
34	AC	1						1	1	1			
36	6x6		1					1	3				
38	2x2	1						1					
39	4x4	11						4					
41	4x4	1											
42	2x2										1		
43	6x6	2	2					1					
45	12x12	1						5					
46	6x6								1				
48	6x6	3	2						3				
49	2x2						1						
50	2x2		1		1	1							
52	2x2	2	1	2			1	2	5	1			2
53	4x4	33	10	2				30	21	7			
55	6x6								1				
56	12x12							1					
58	6x6							2					
60	12x12	2						2					
62	4x4	7	4					7	8				
65	AC			1									

Legend:
Boxes represent number of slabs in each particular section
Each number in the box represents the number of cracks found in each slab within the section

Figure B.2 Longitudinal crack locations

Section #	Slab Dimension	SBL 1	SBL 2	SBL 3	SBL 4	SBL 5	SBL 6	NBL 1	NBL 2	NBL 3	NBL 4	NBL 5	NBL 6
9T	4x4							1					
10	2x2	26	27	26	11	12	11	22	23	22	11	12	10
16	AC	12	13	13				13	13	12			
23	2x2	30	31	30	14	14	14	22	22	22	18	19	18
29	4x4	1	2	1				1	1	1			
34	AC	21	21	19				18	18	17			
36	6x6	1	1					1					
38	2x2	2	1										
39	4x4	4	1	11				22	16	15			
41	4x4			3				6	4	4			
43	6x6	3	3					6	5				
45	12x12							2					
52	2x2					1							
53	4x4	61	59	33				65	65	33			
62	4x4	56	60	35				26	27	14			
65	AC	22	20	25				20	19	26			

Legend:

Boxes represent number of slabs in each particular section

Each number in the box represents the number of cracks found in each slab within the section

Figure B.3 Transverse crack locations

Section #	Slab Dimension	SBL 1	SBL 2	SBL 3	SBL 4	SBL 5	SBL 6	NBL 1	NBL 2	NBL 3	NBL 4	NBL 5	NBL 6
1	20x12	-						1					
10	2x2	1						1	1				
29	4x4	1											
38	2x2									1			
52	2x2		1	1					1				
65	AC	1											

Legend:

Boxes represent number of slabs in each particular section

Each number in the box represents the number of cracks found in each slab within the section

Figure B.4 Diagonal crack locations

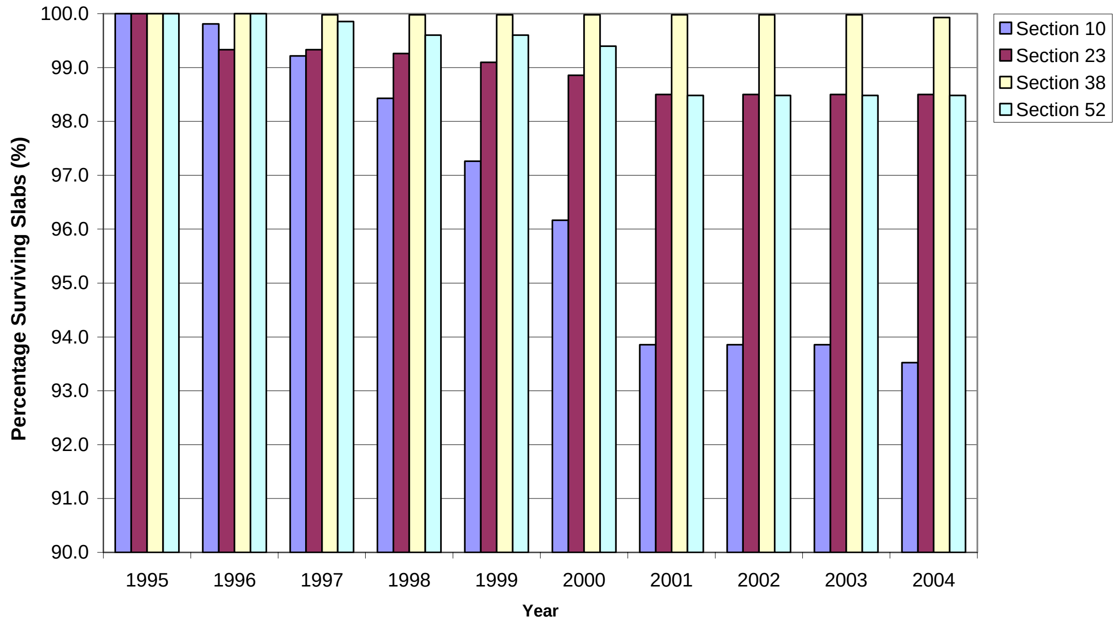


Figure B.5 Longitudinal cracks 2 in. depth, 2 ft. squares

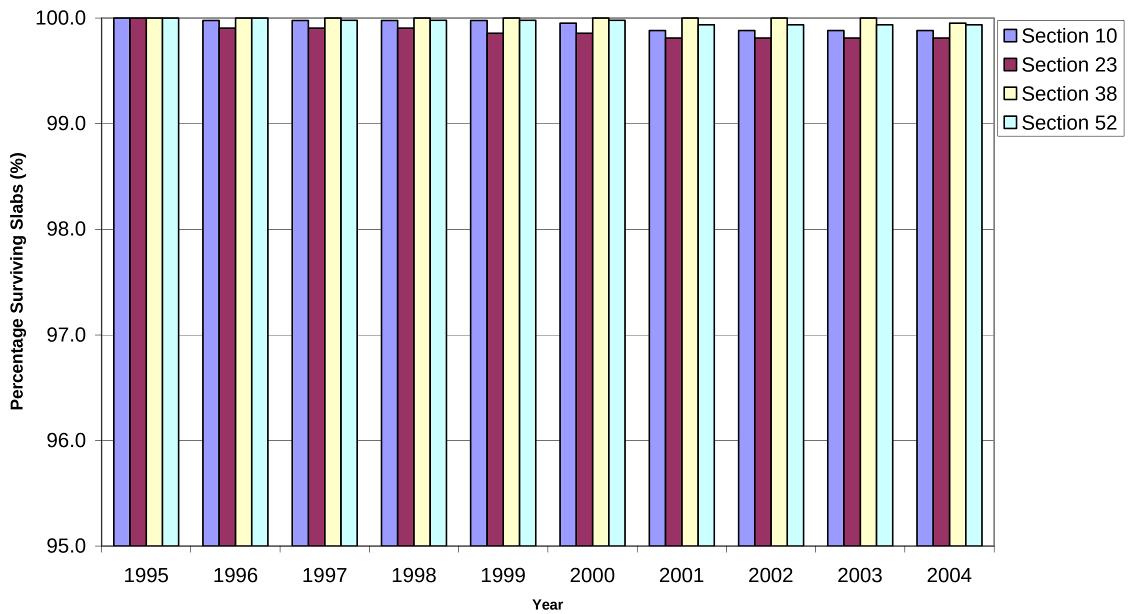


Figure B.6 Transverse cracks 2 in. depth, 2 ft. squares

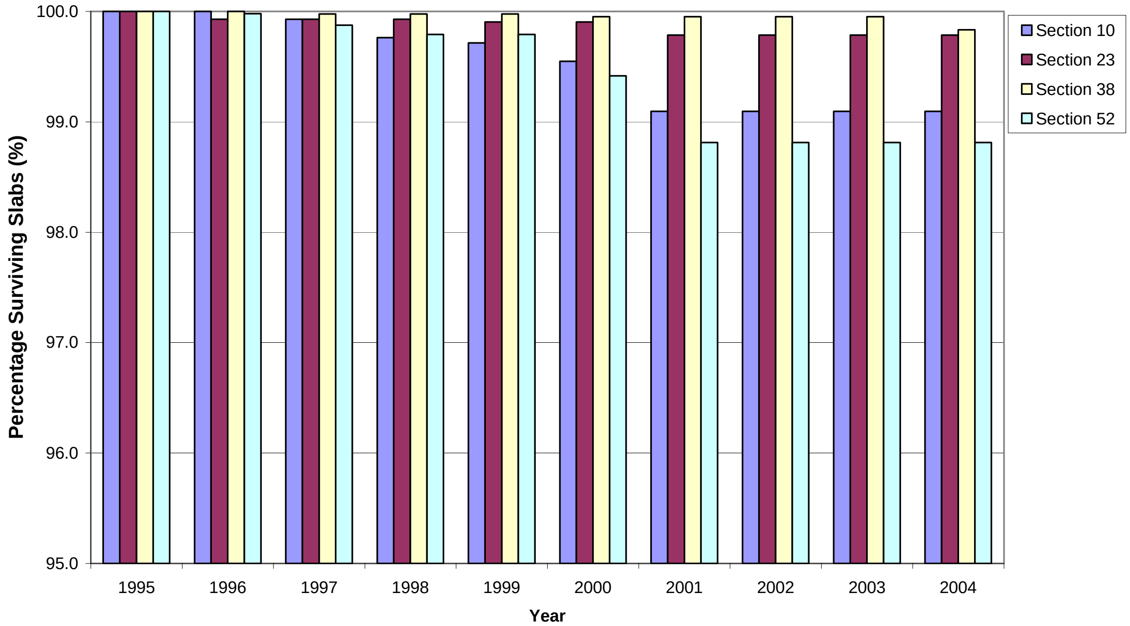


Figure B.7 Corner cracks 2 in. depth, 2 ft. squares

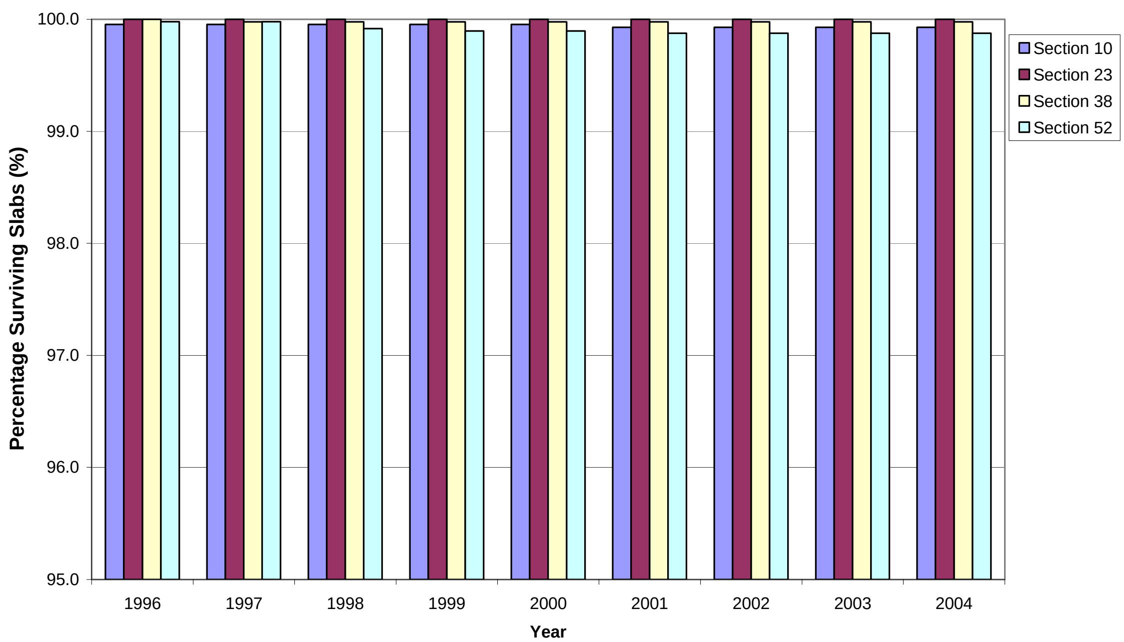


Figure B.8 Diagonal cracks 2 in. depth, 2 ft. squares

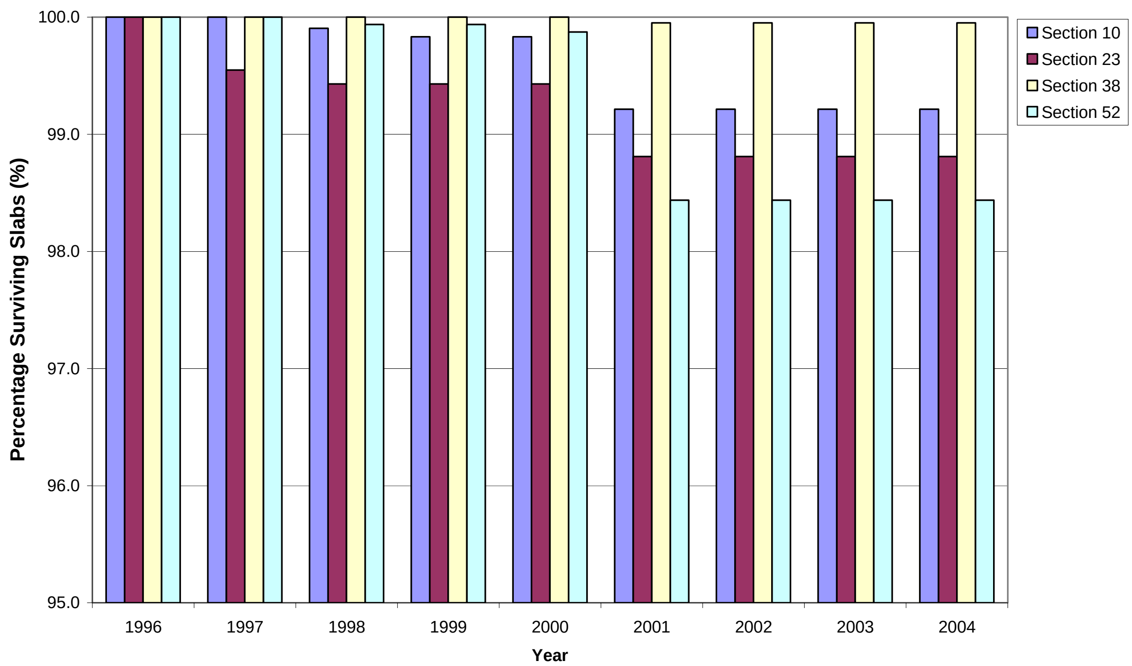


Figure B.9 Fractured slabs 2 in. depth, 2 ft. squares

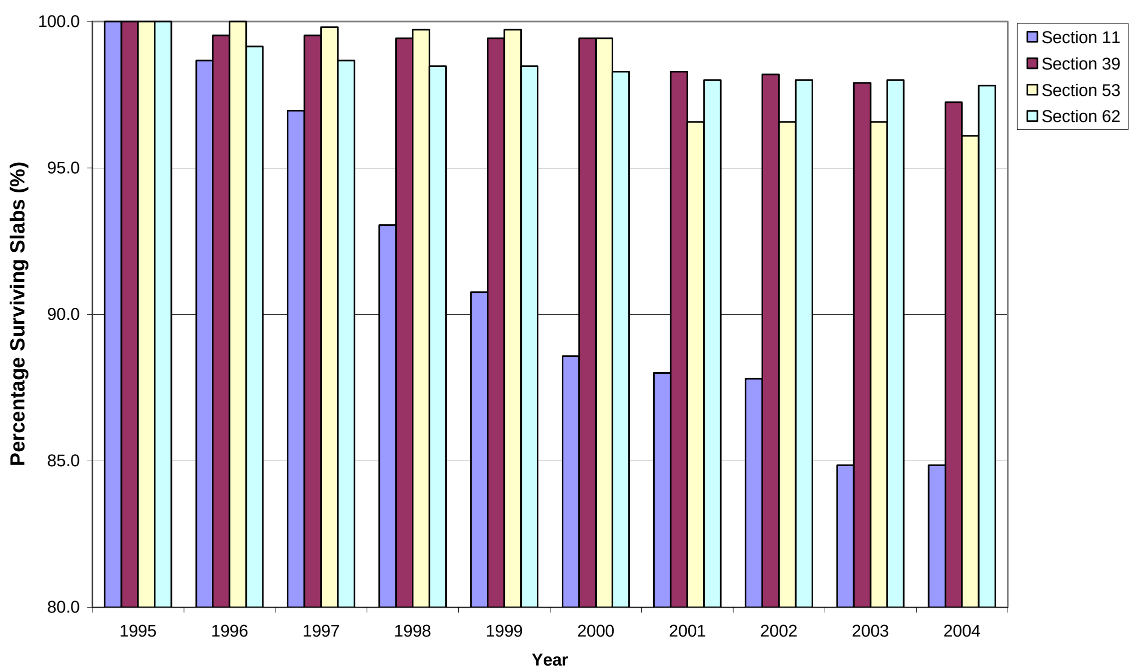


Figure B.10 Longitudinal cracks 2 in. depth, 4 ft. squares

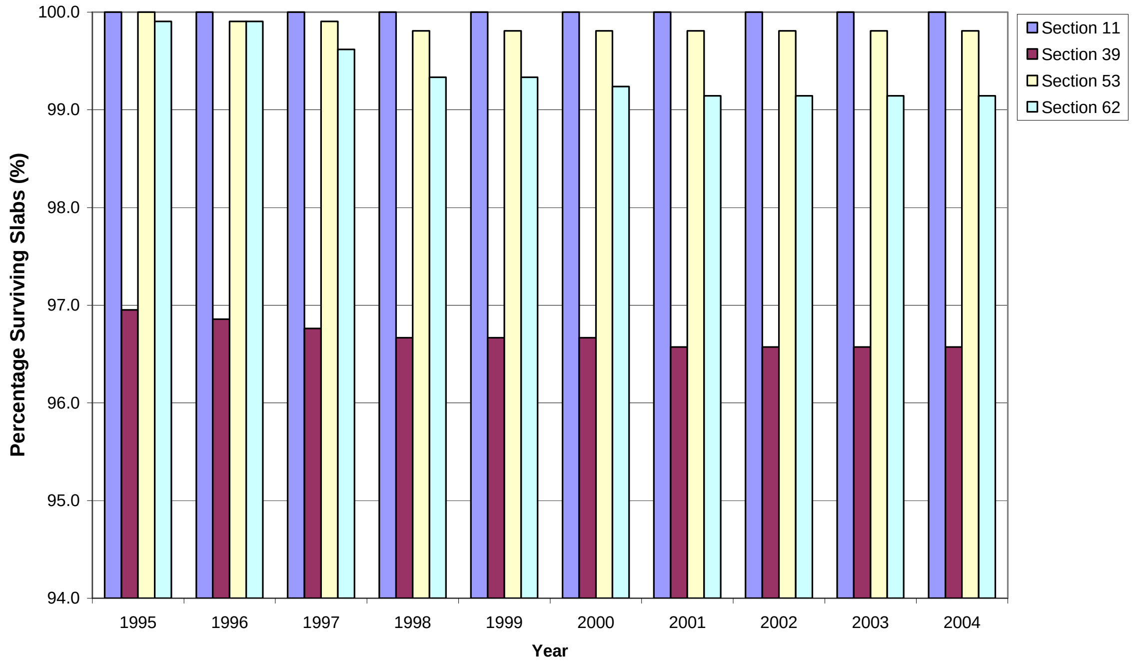


Figure B.11 Transverse cracks 2 in. depth, 4 ft. squares

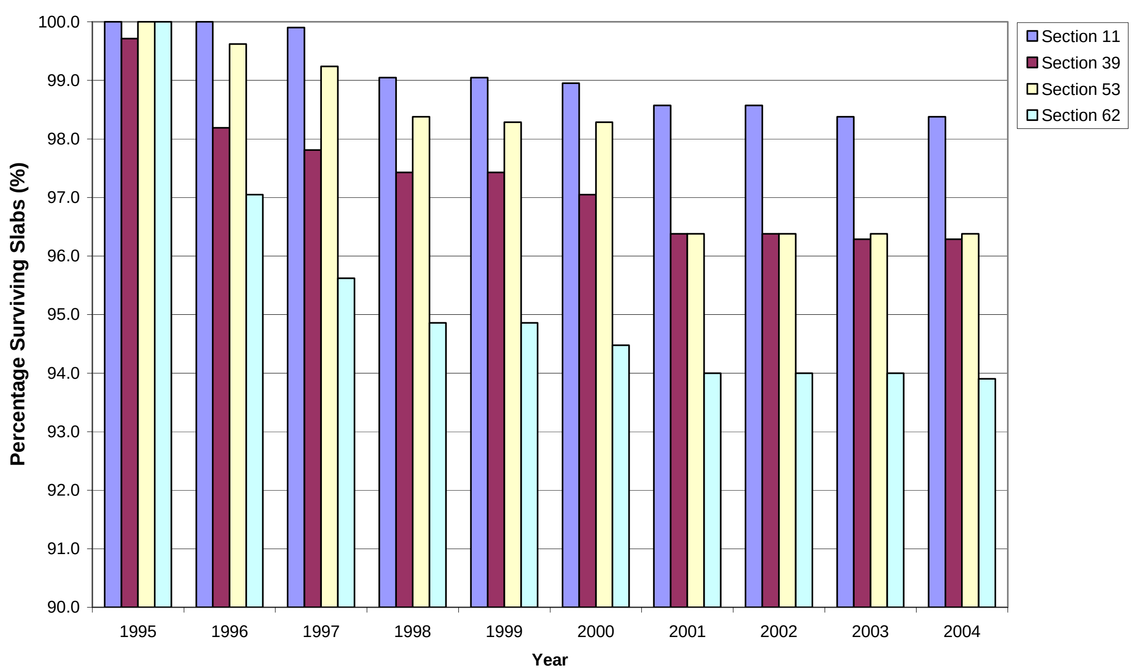


Figure B.12 Corner cracks 2 in. depth, 4 ft. squares

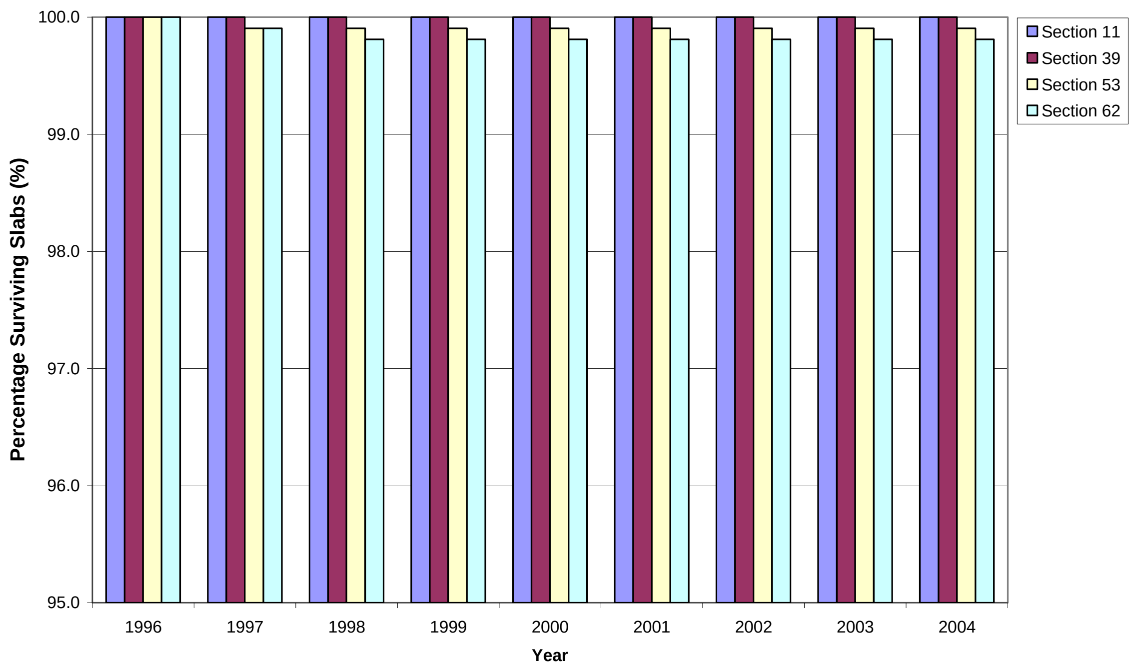


Figure B.13 Diagonal cracks 2 in. depth, 4 ft. squares

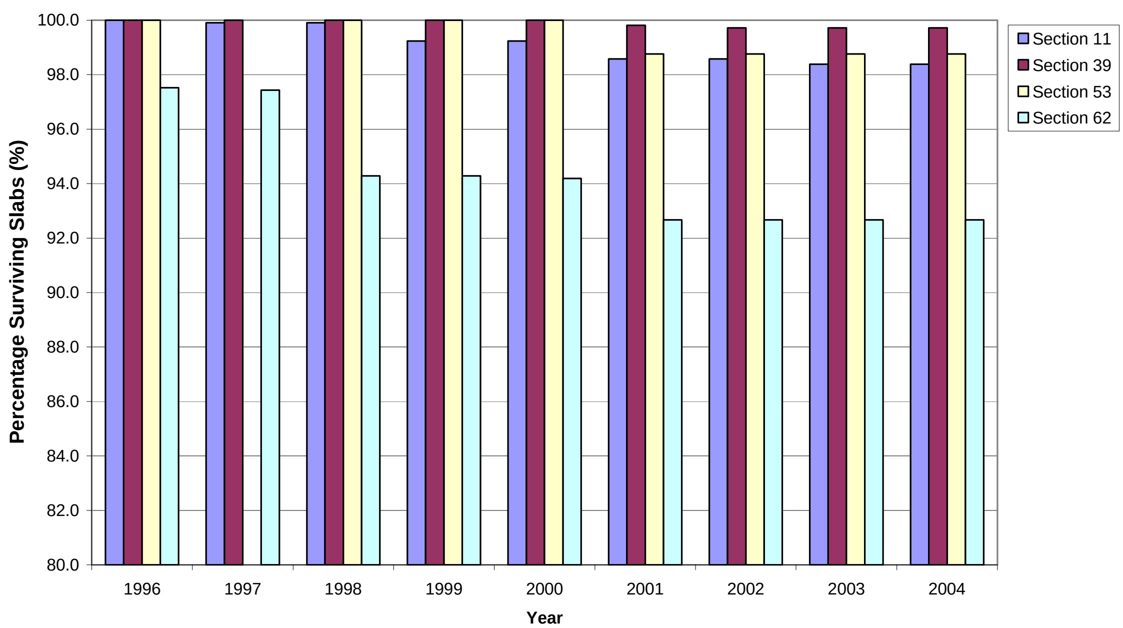


Figure B.14 Fractured slabs 2 in. depth, 4 ft. squares

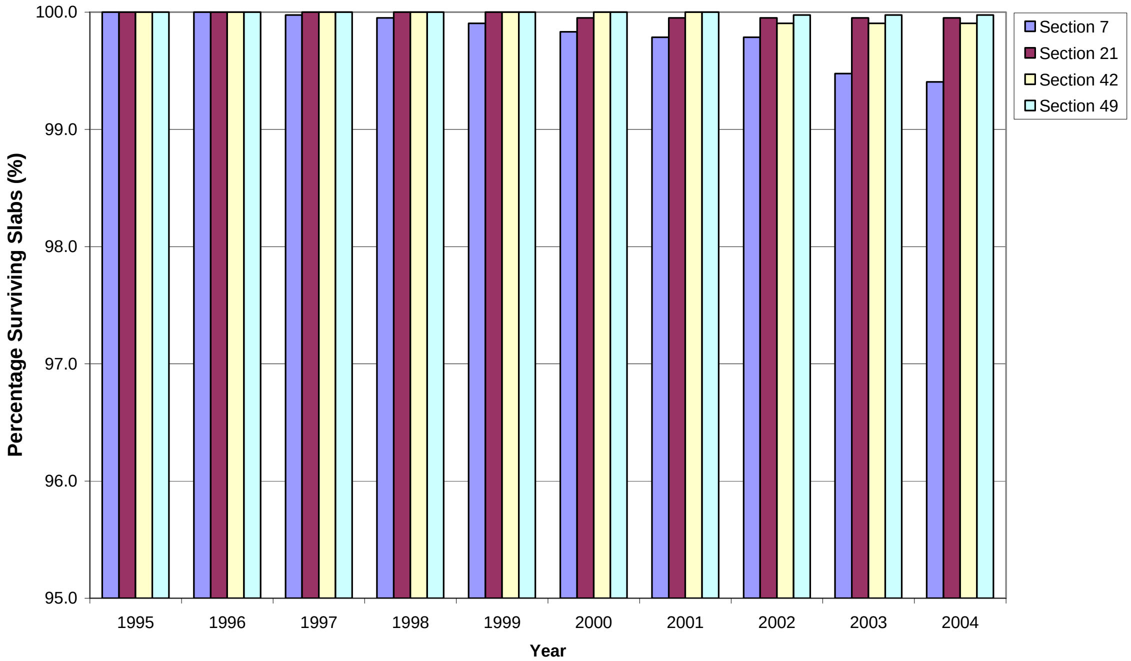


Figure B.15 Longitudinal cracks 4 in. depth, 2 ft. squares

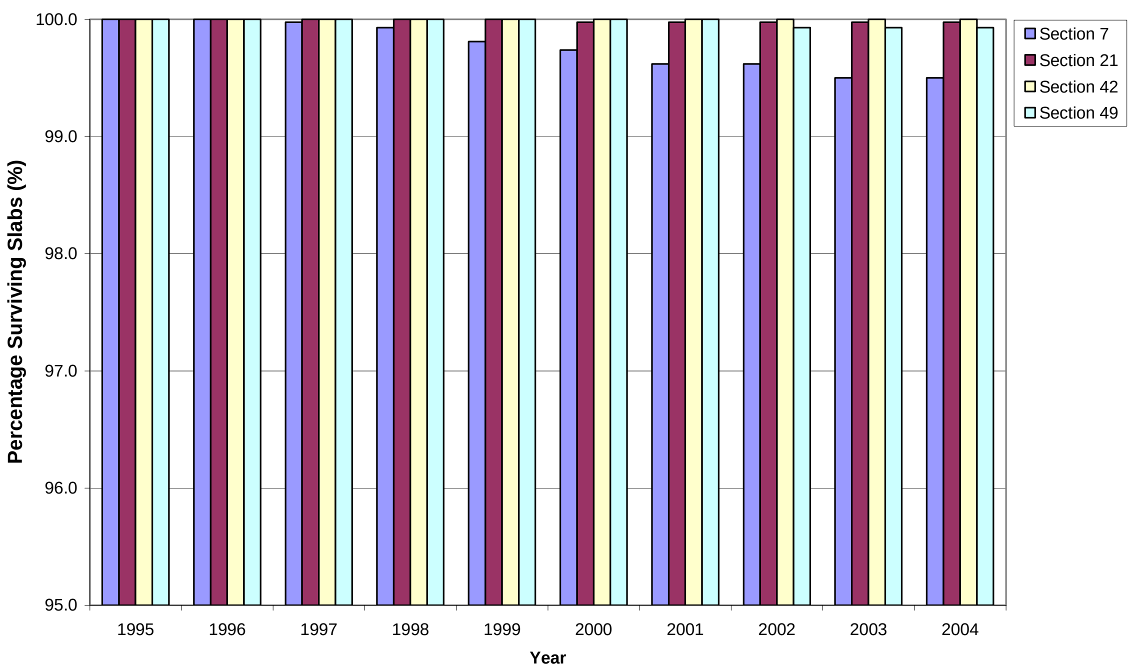


Figure B.16 Corner cracks 4 in. depth, 2 ft. squares

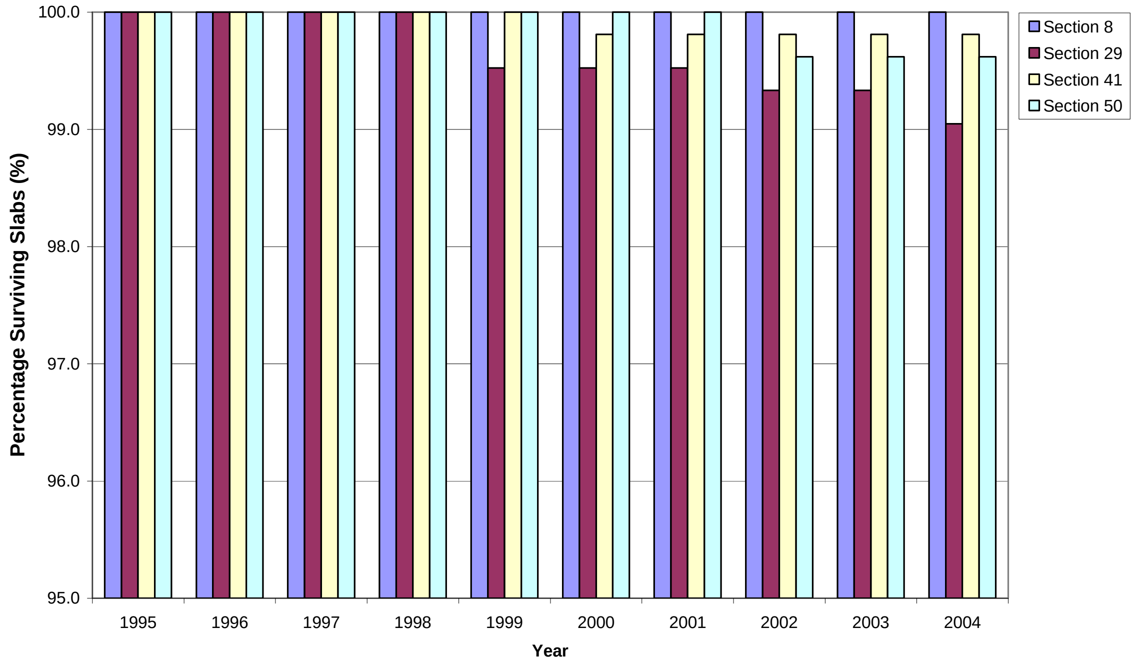


Figure B.17 Longitudinal cracks 4 in. depth, 4 ft. squares

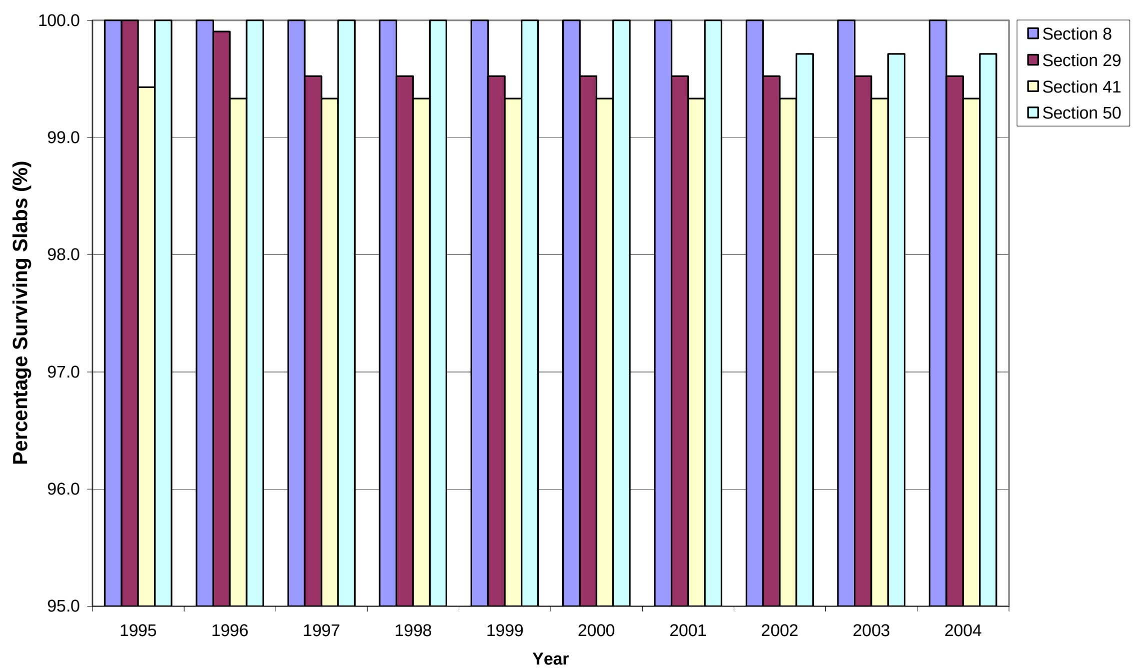


Figure B.18 Transverse cracks 4 in. depth, 4 ft. squares

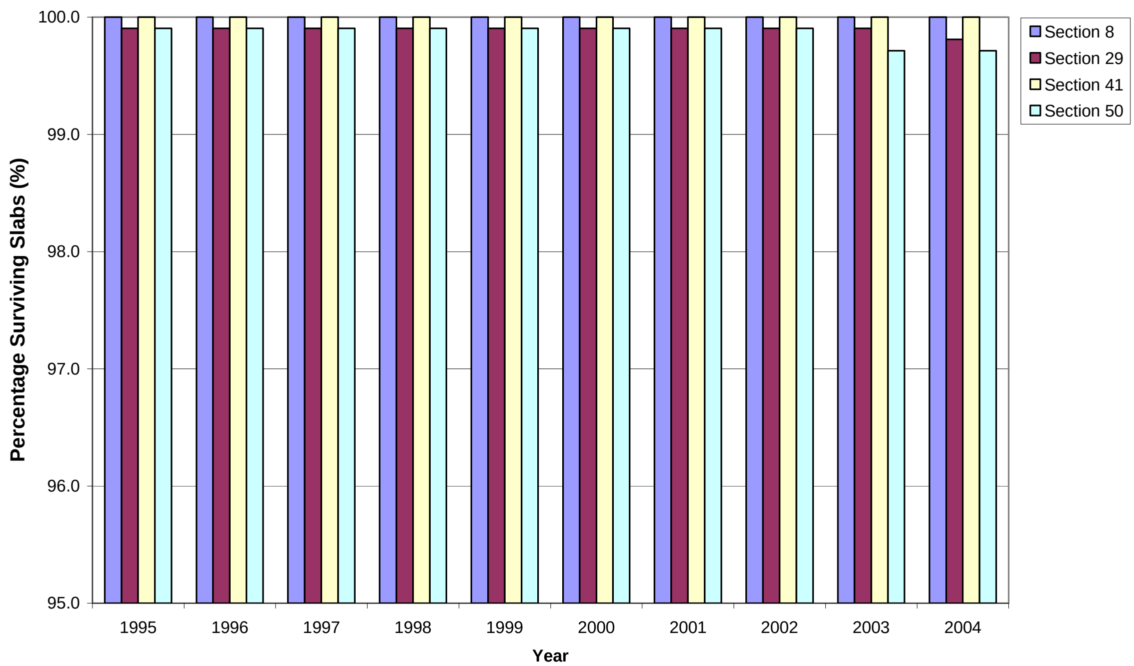


Figure B.19 Corner cracks 4 in. depth, 4 ft. squares

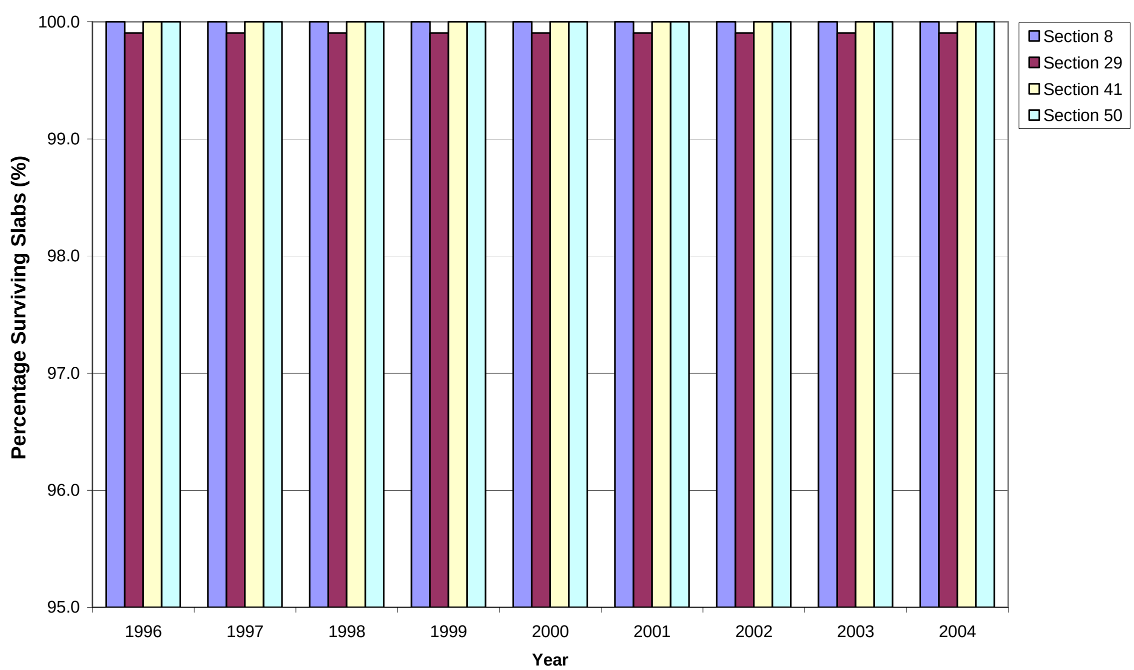


Figure B.20 Diagonal cracks 4 in. depth, 4 ft. squares

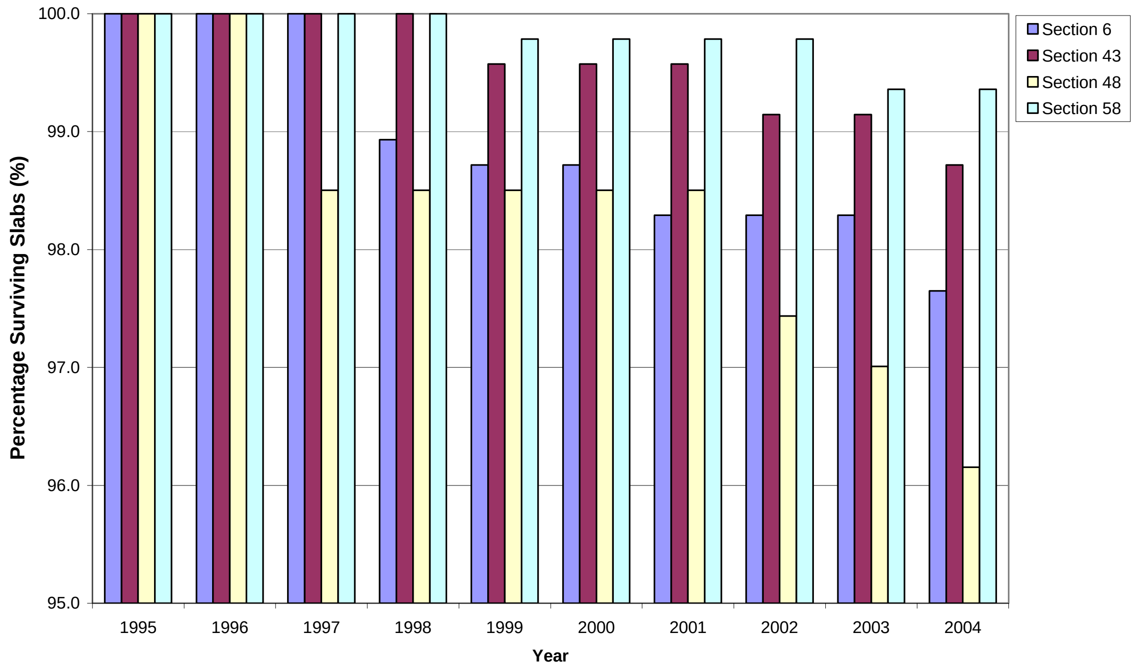


Figure B.21 Longitudinal cracks 4 in. depth, 6 ft. squares

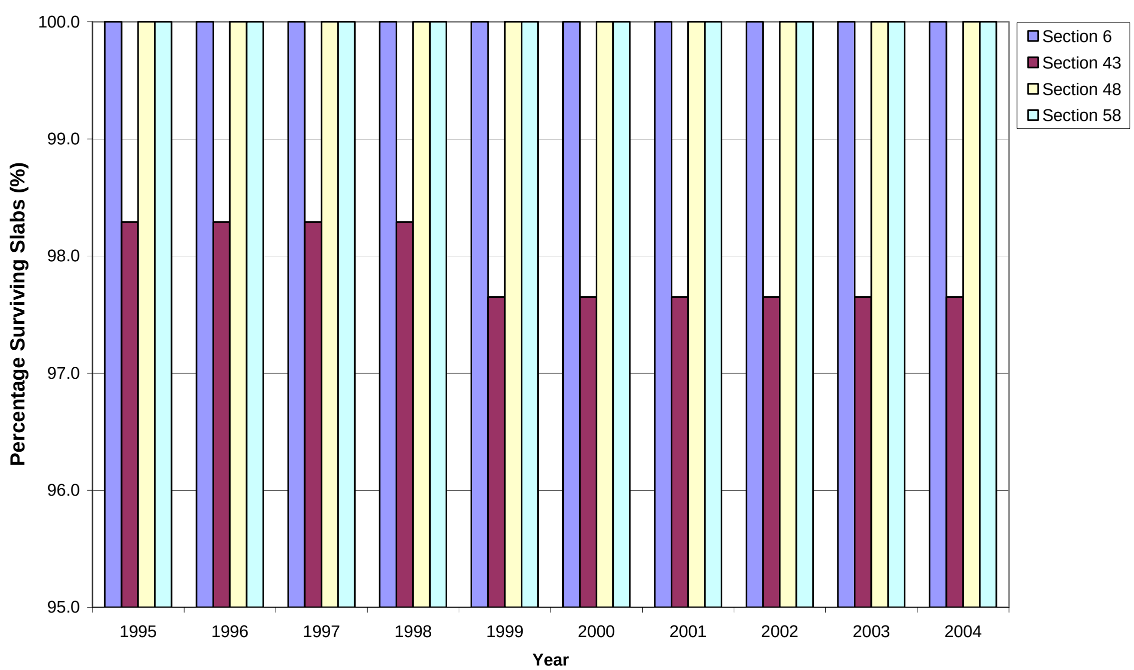


Figure B.22 Transverse cracks 4 in. depth, 6 ft. squares

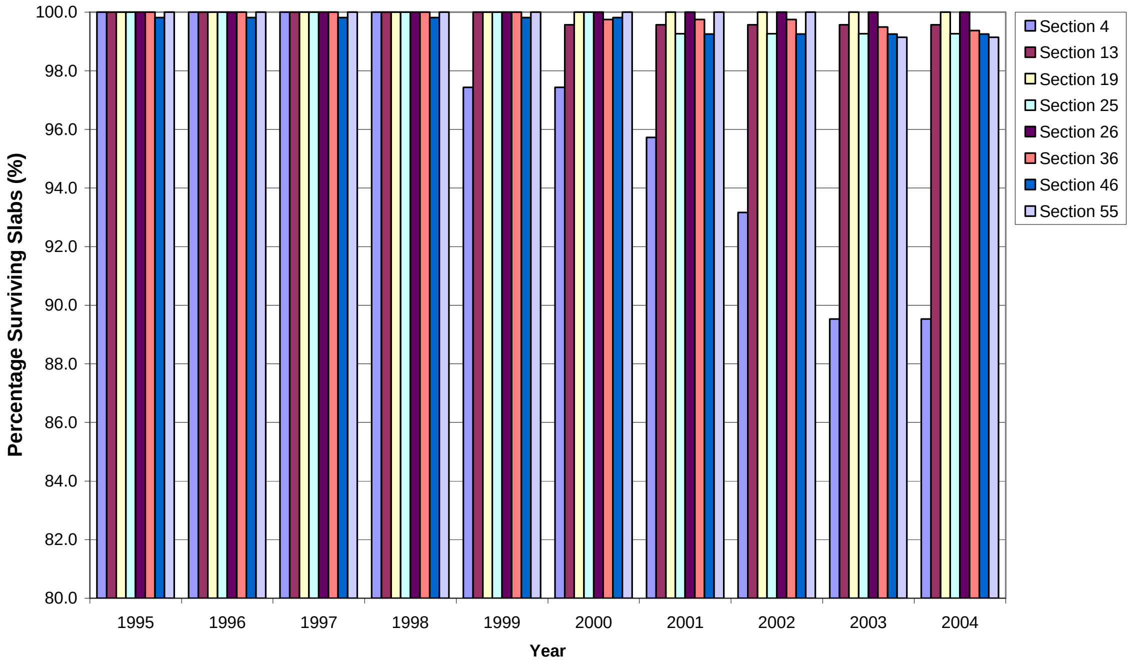


Figure B.23 Longitudinal cracks 6 in. depth, 6 ft. squares

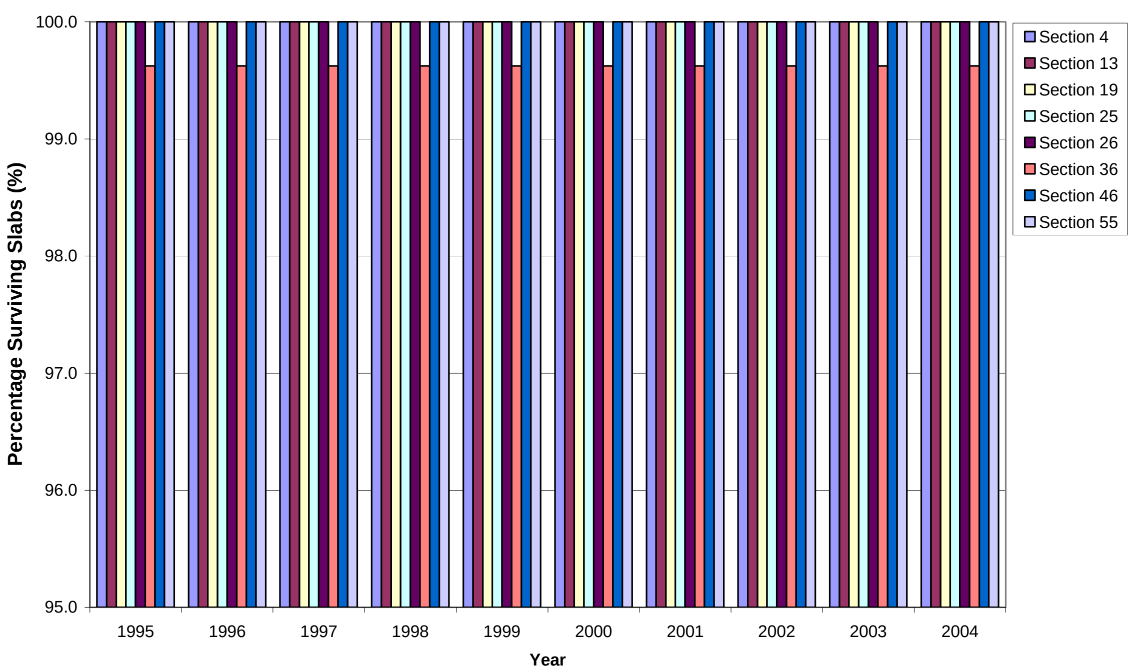


Figure B.24 Transverse cracks 6 in. depth, 6 ft. squares

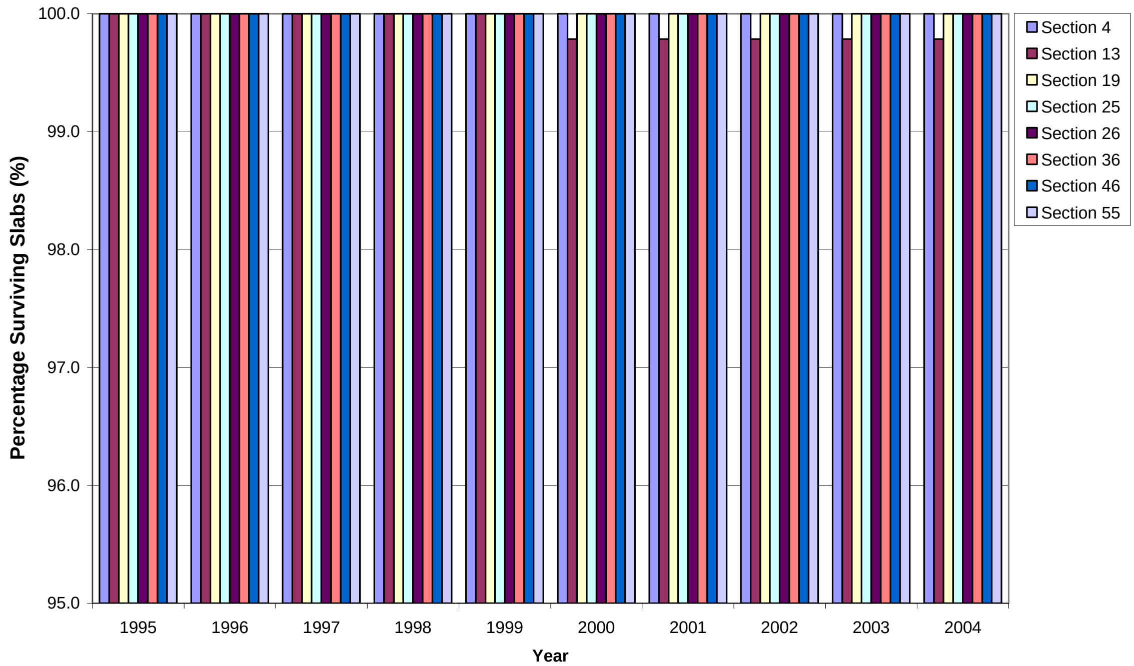


Figure B.25 Corner cracks 6 in. depth, 6 ft. squares

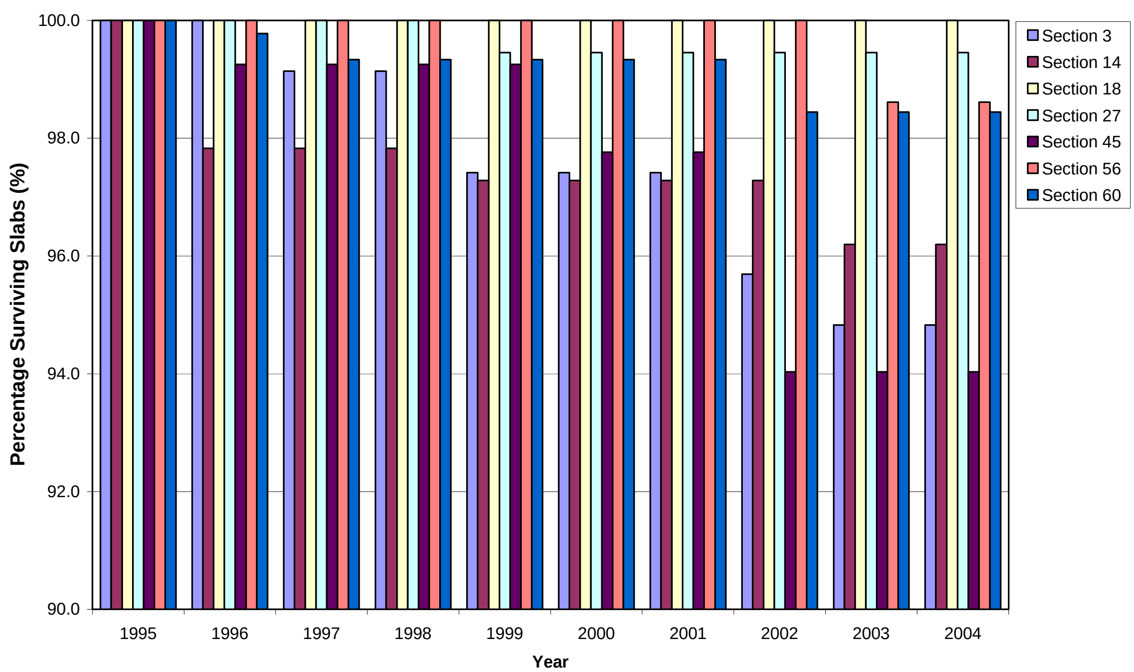


Figure B.26 Longitudinal cracks 6 in. depth, 12 ft. squares

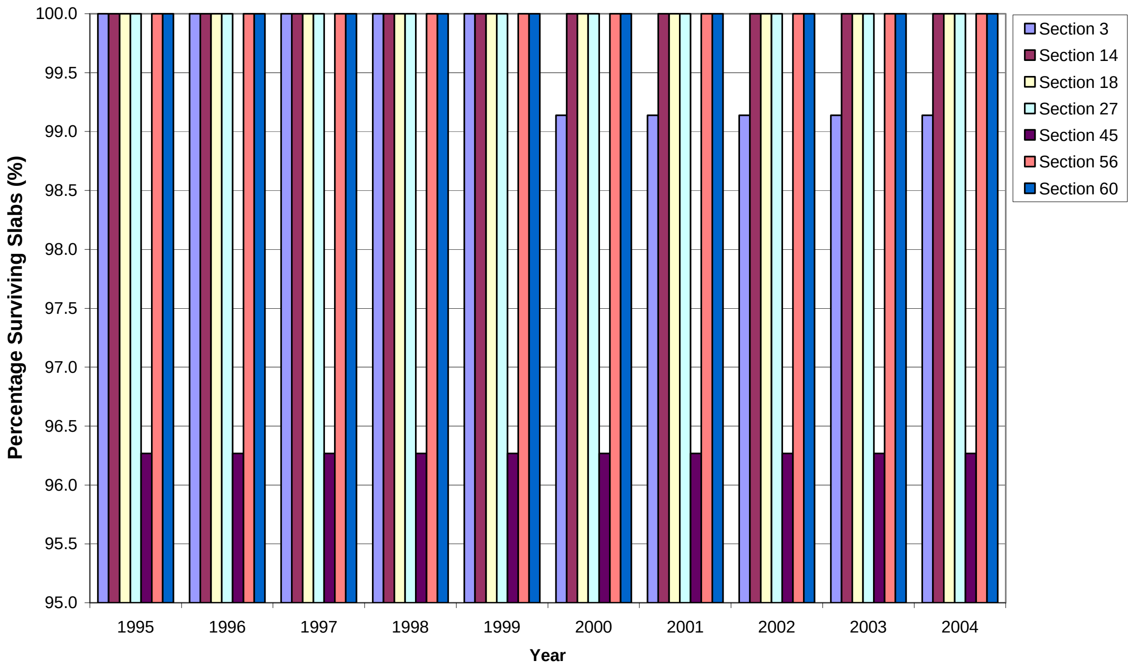


Figure B.27 Transverse cracks 6 in. depth, 12 ft. squares

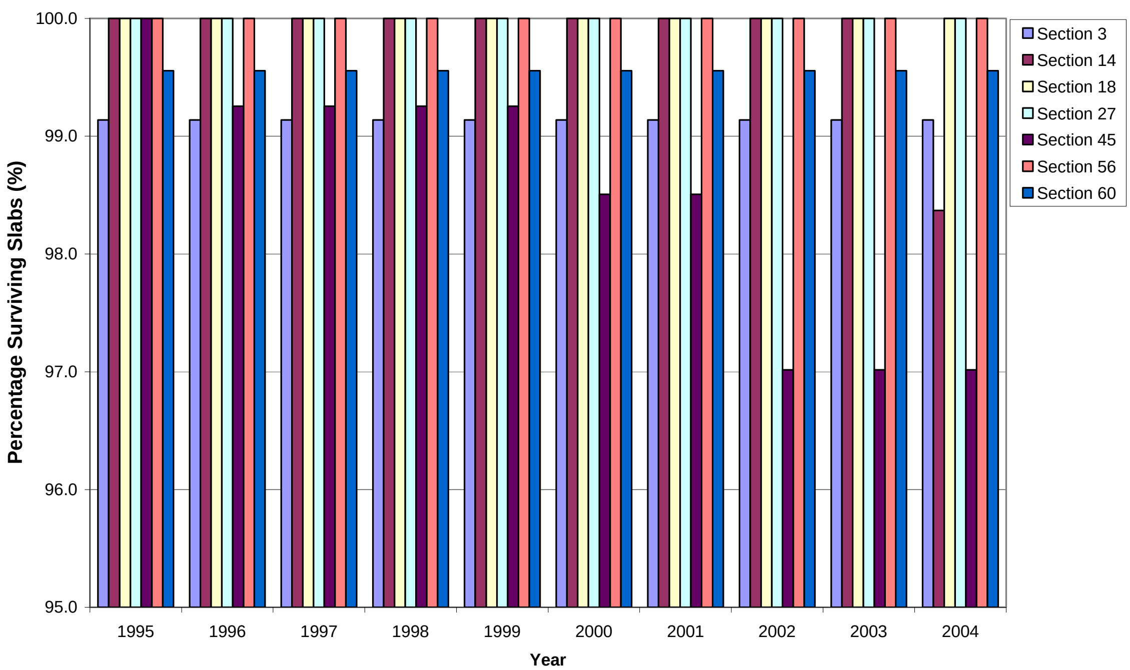


Figure B.28 Corner cracks 6 in. depth, 12 ft. squares

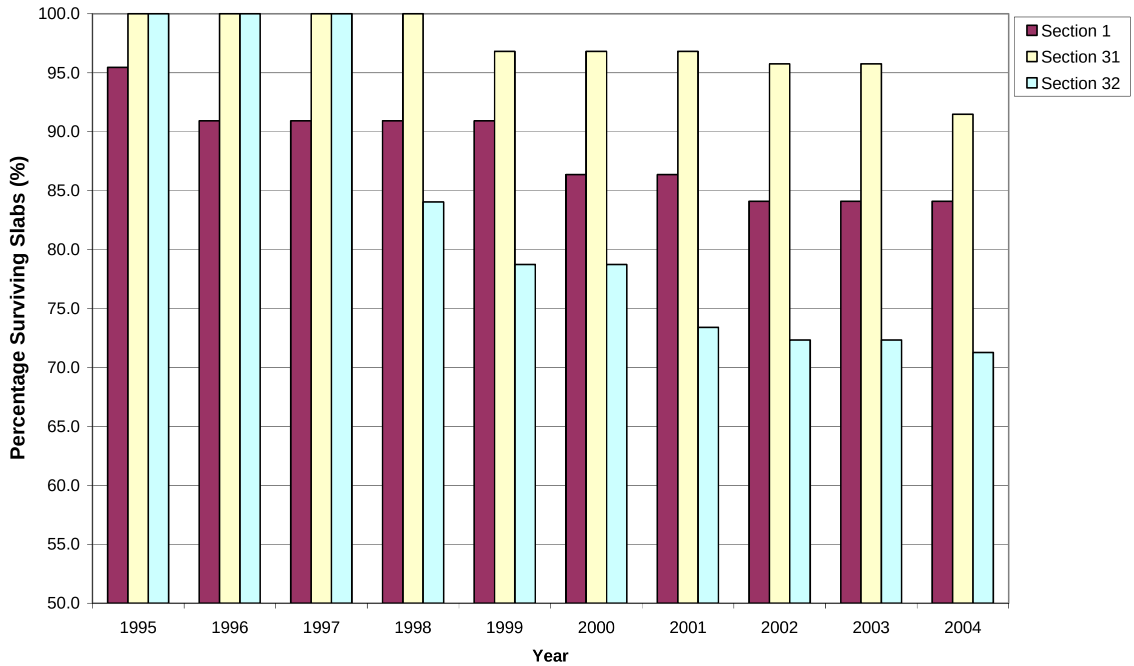


Figure B.29 Longitudinal cracks 8 in. depth 12x20 and 12x15 ft. slabs

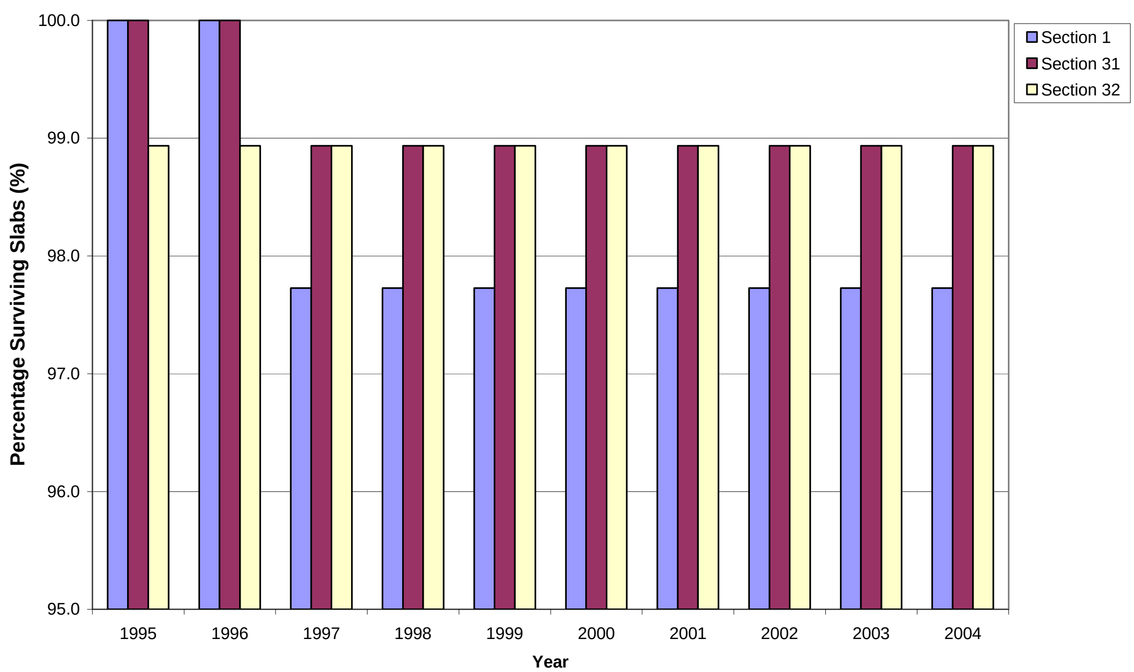


Figure B.30 Transverse cracks 8 in. depth 12x20 and 12x15 ft. slabs

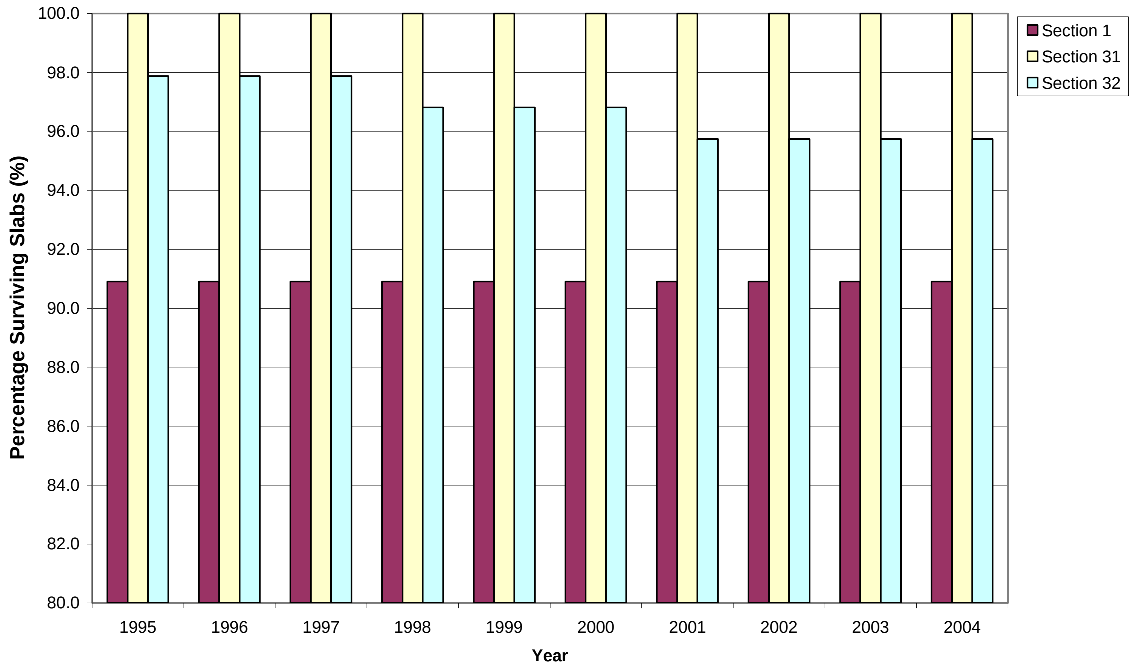


Figure B.31 Corner cracks 8 in. depth 12x20 and 12x15 ft. slabs

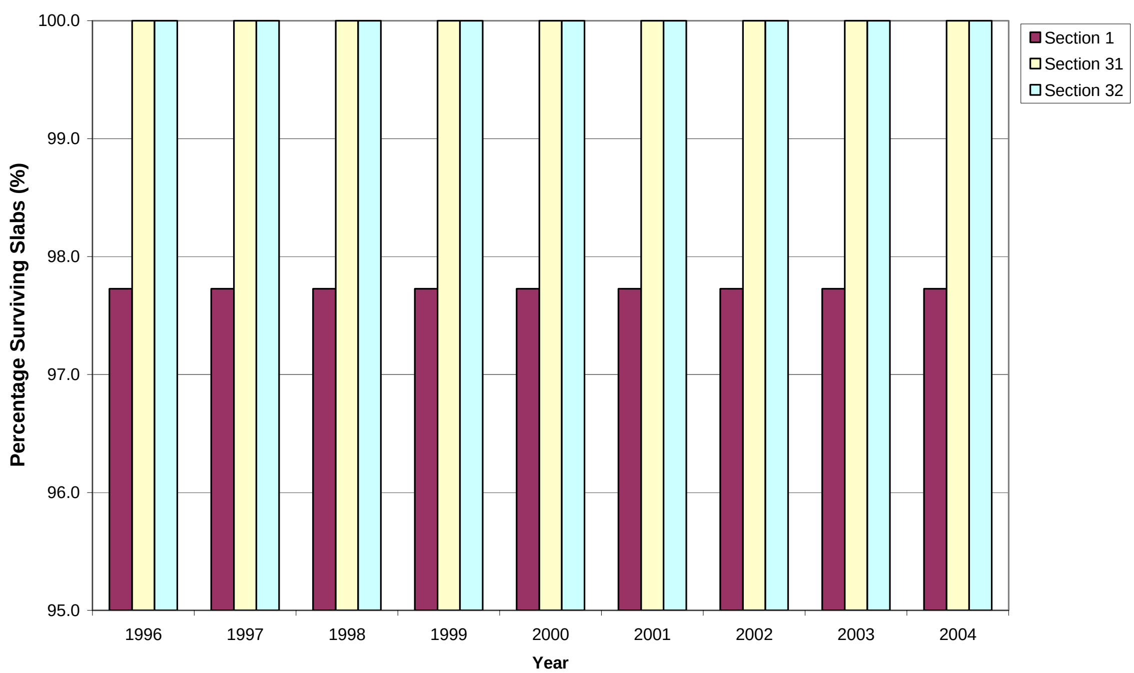


Figure B.32 Diagonal cracks 8 in. depth 12x20 and 12x15 ft. slabs

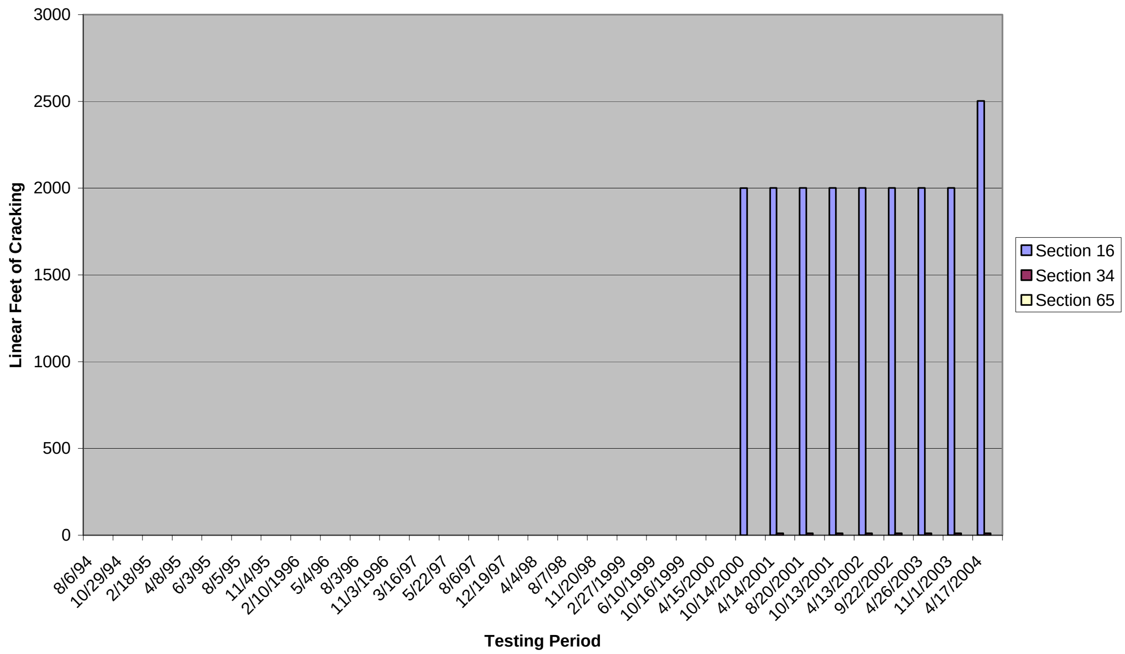


Figure B.33 Longitudinal cracks 4.5 in. depth ACC

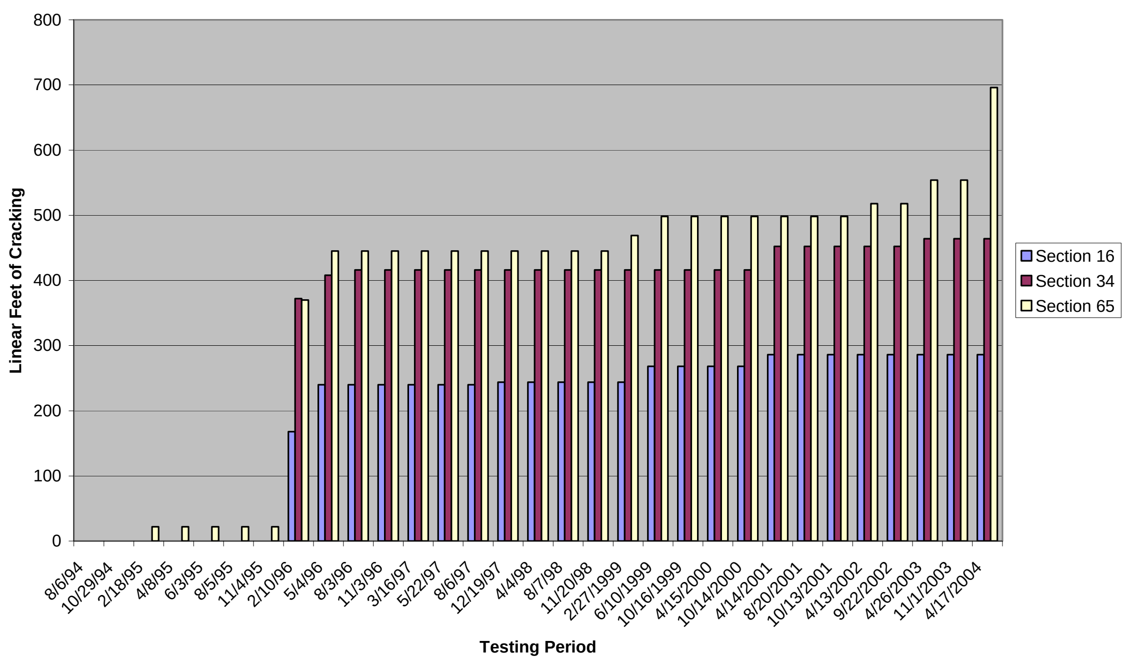


Figure B.34 Transverse cracks 4.5 in. depth ACC

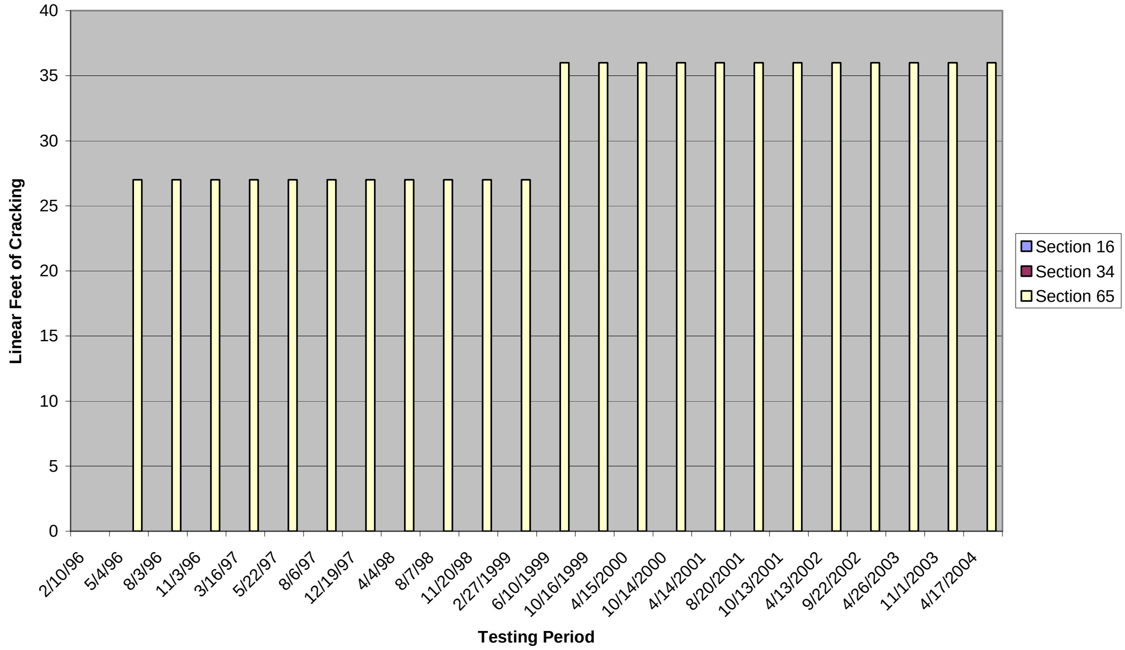


Figure B.35 Diagonal cracks 4.5 in. depth ACC

APPENDIX C: FALLING WEIGHT DEFLECTOMETER GRAPHS

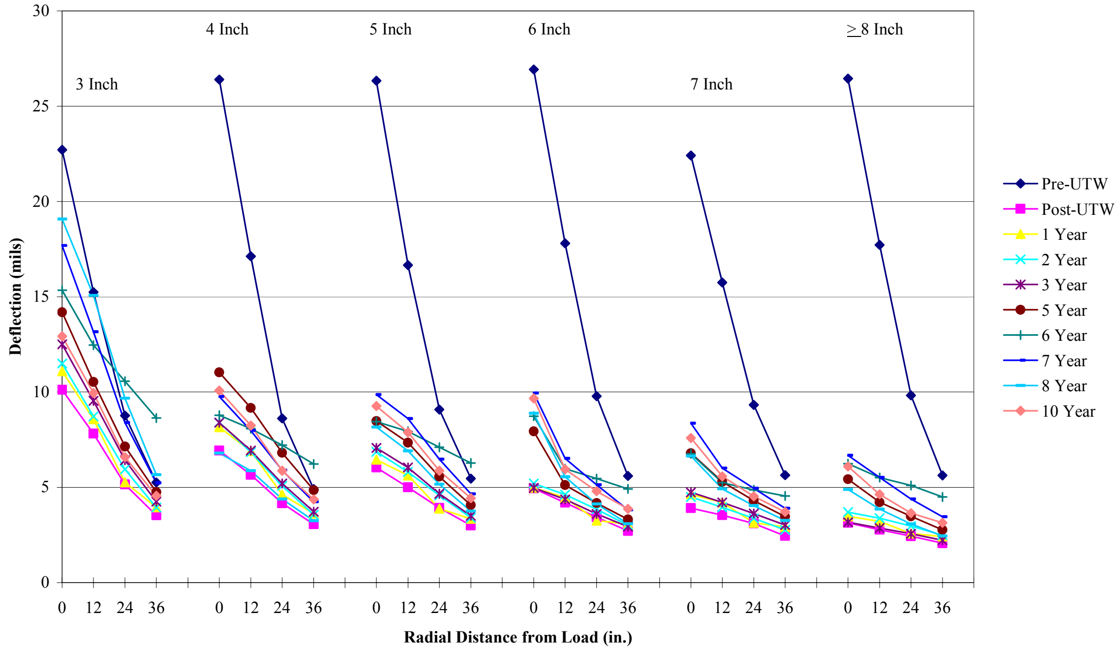


Figure C.1 Average deflection basins for various PCC thicknesses over time

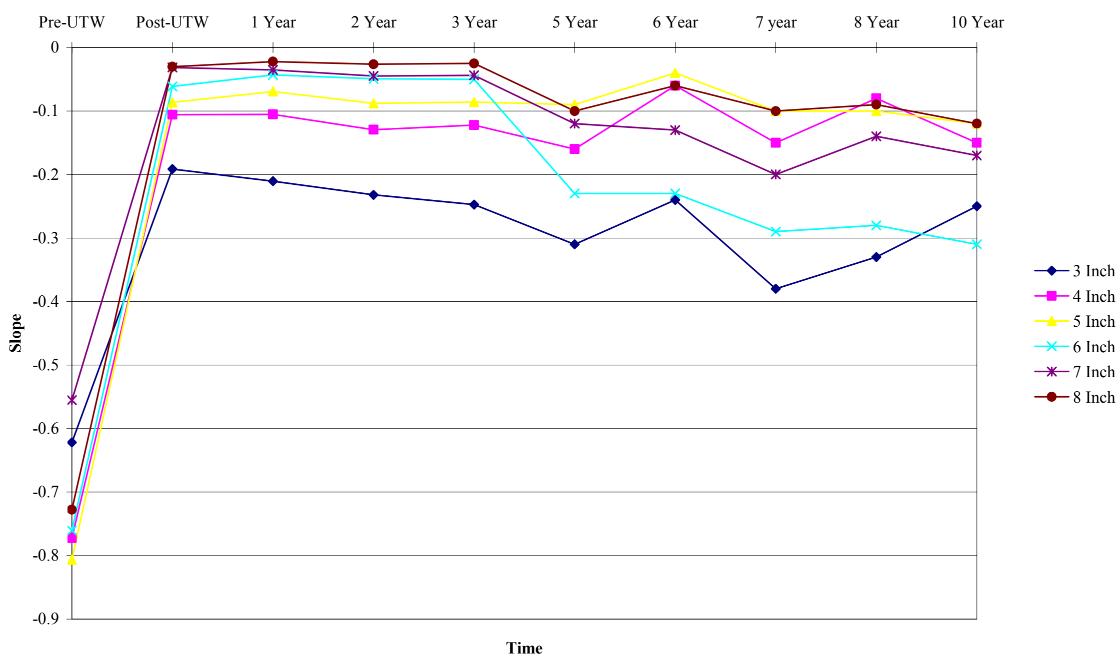


Figure C.2 Average slopes between D0 and D1 for various PCC thicknesses over time

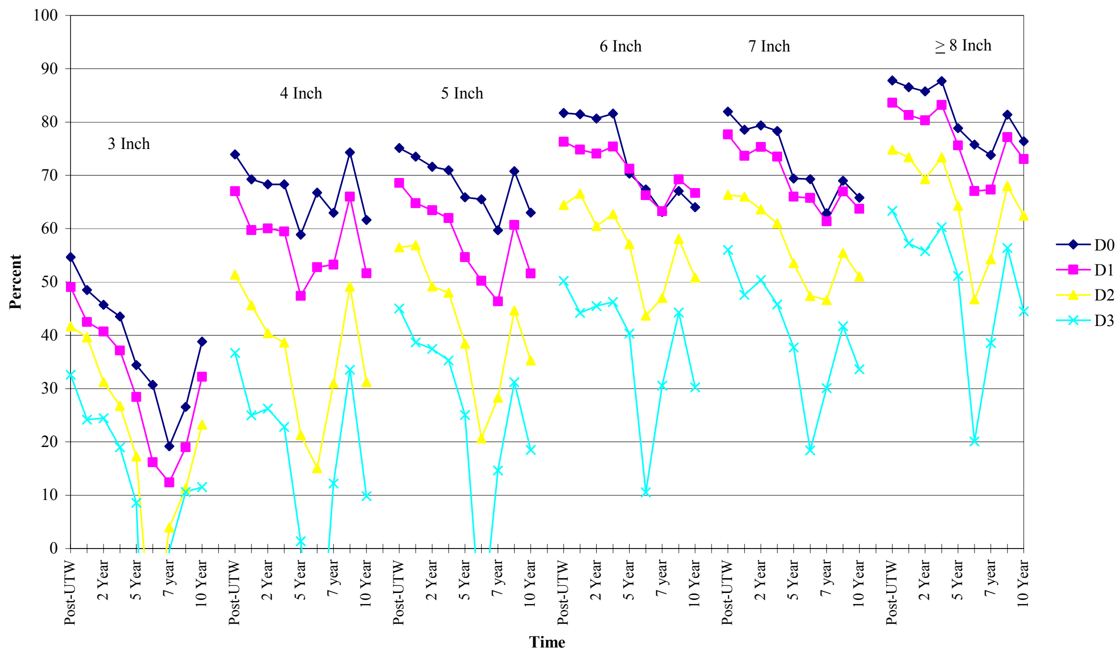


Figure C.3 Percent reduction in average deflections for various PCC thicknesses over time

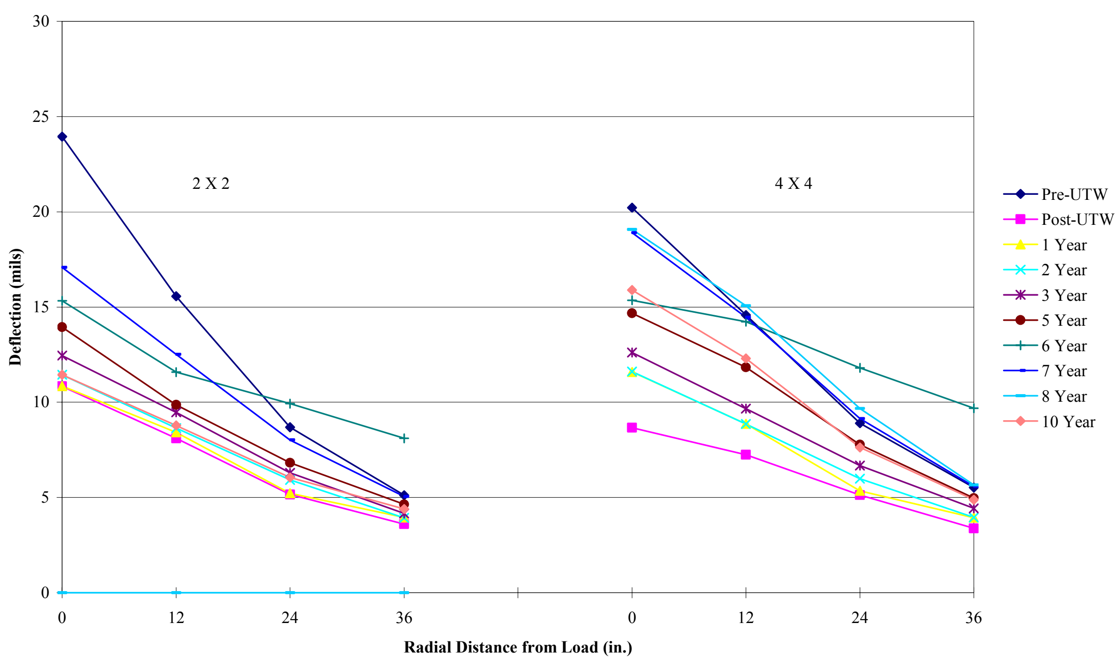


Figure C.4 Average deflection basins for various joint spacings with 3 inch PCC over time

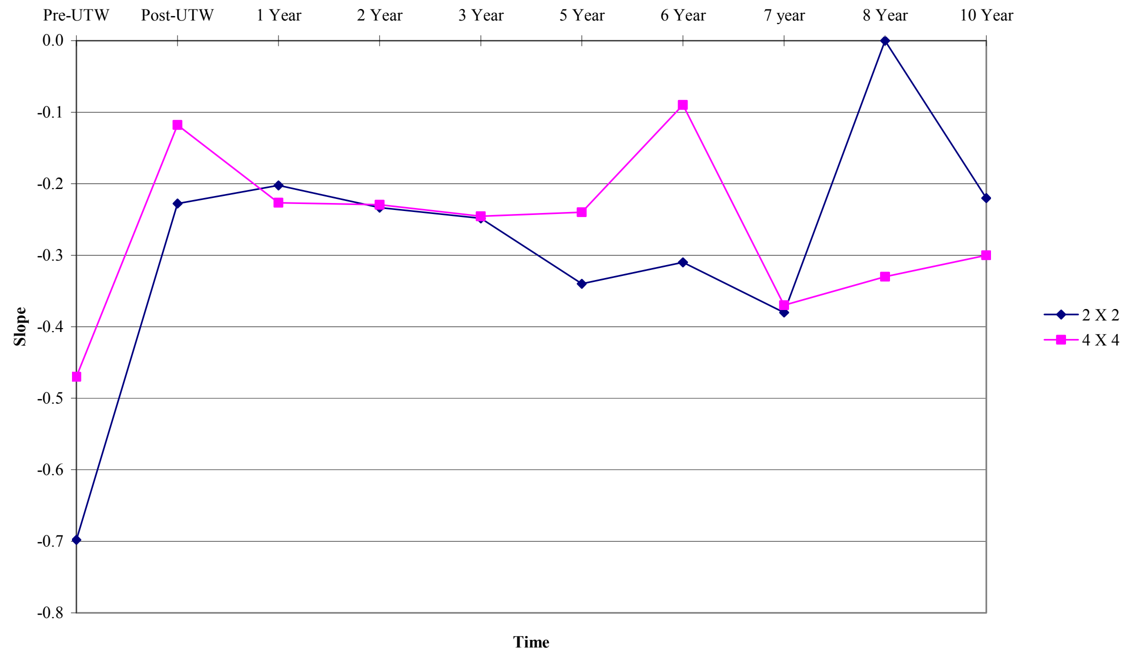


Figure C.5 Average slopes between D0 and D1 for various joint spacings with 3 inch PCC over time

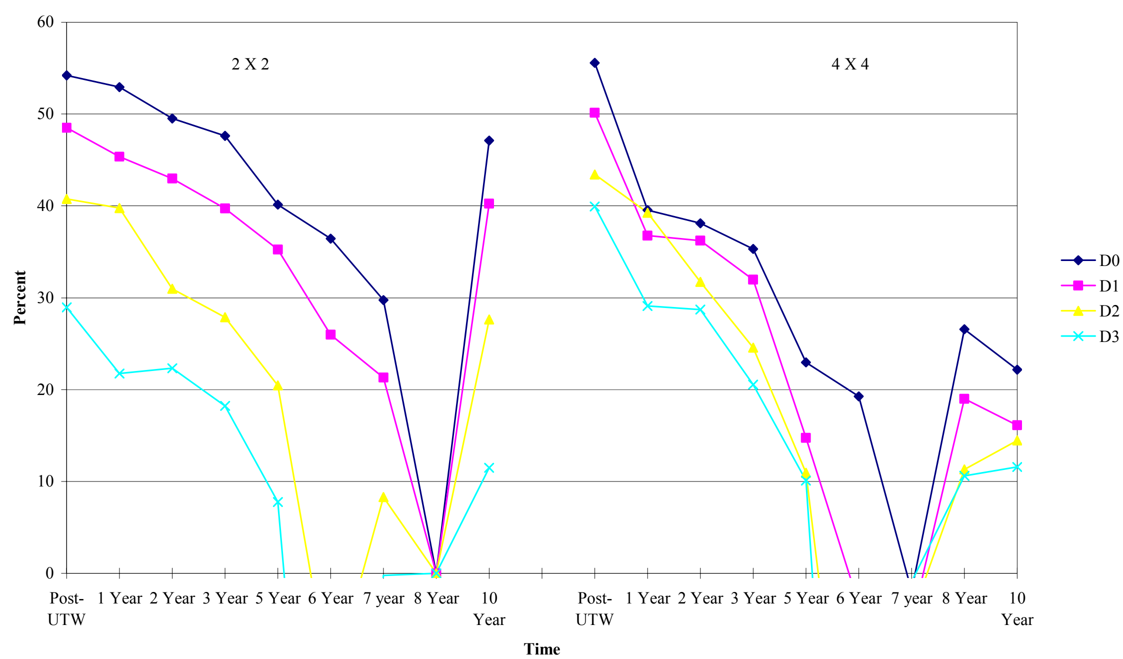


Figure C.6 Percent reduction in average deflections for various joint spacings with 3 inch PCC over time

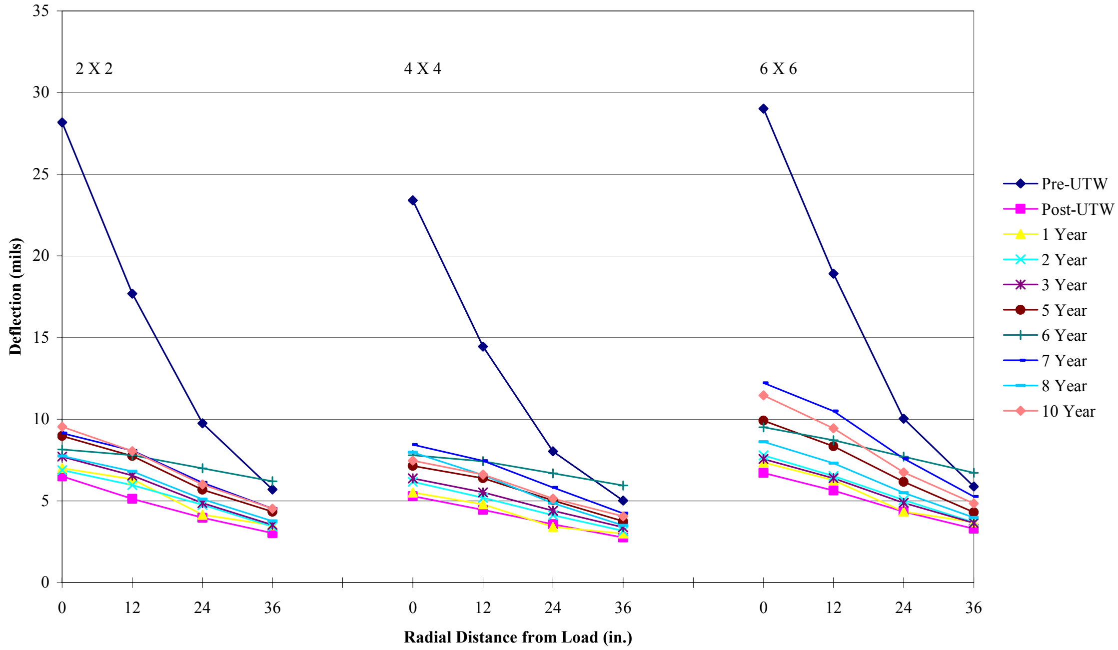


Figure C.7 Average deflection basins for various joint spacings with 5 inch PCC over time

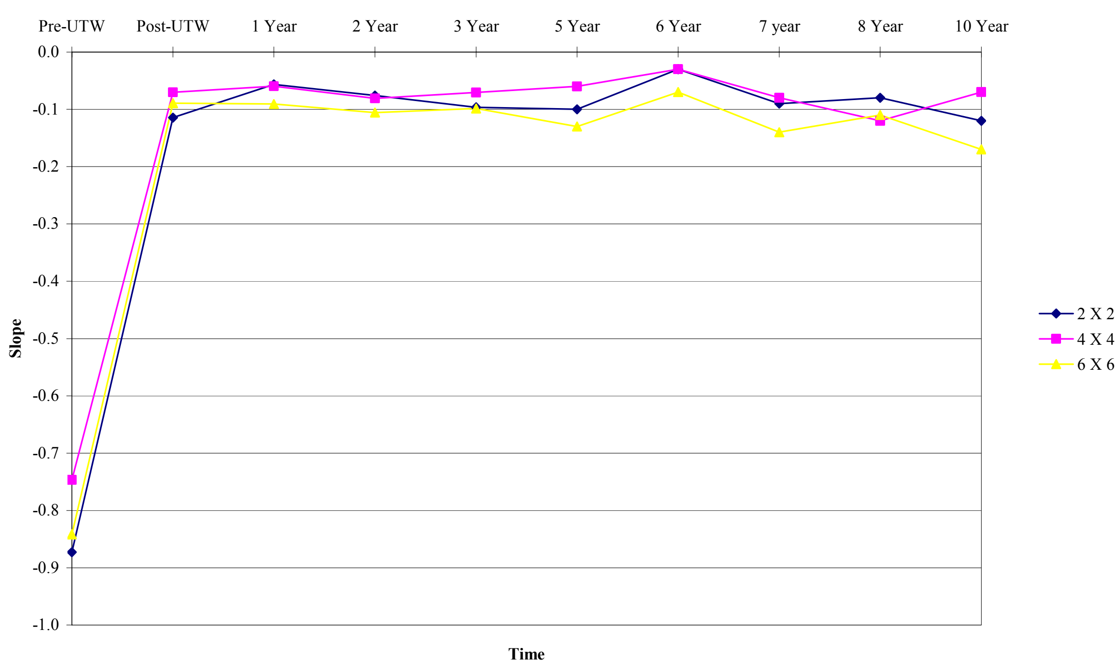


Figure C.8 Average slopes between D0 and D1 for various joint spacings with 5 inch PCC over time

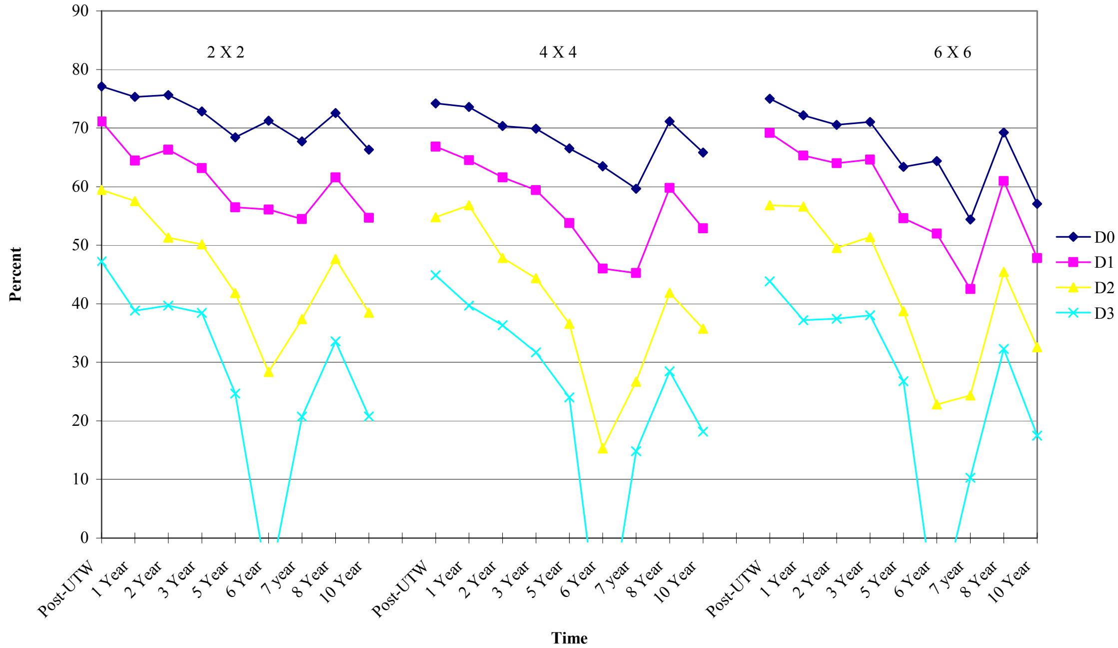


Figure C.9 Percent reduction in average deflections for various joint spacings with 5 inch PCC over time

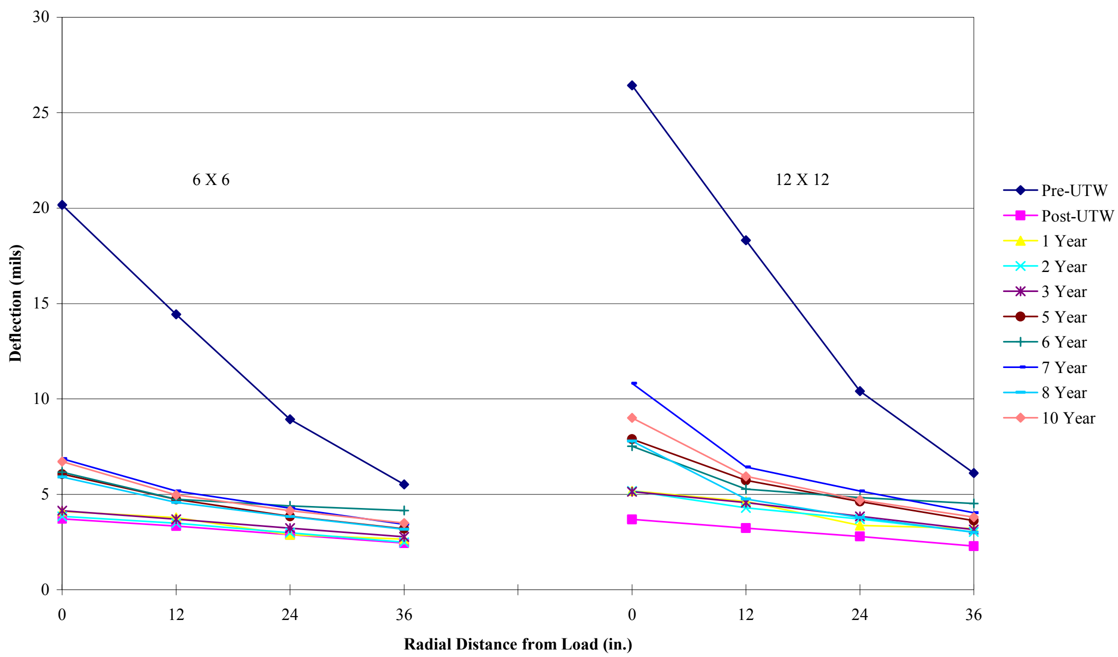


Figure C.10 Average deflection basins for various joint spacings with 7 inch PCC over time

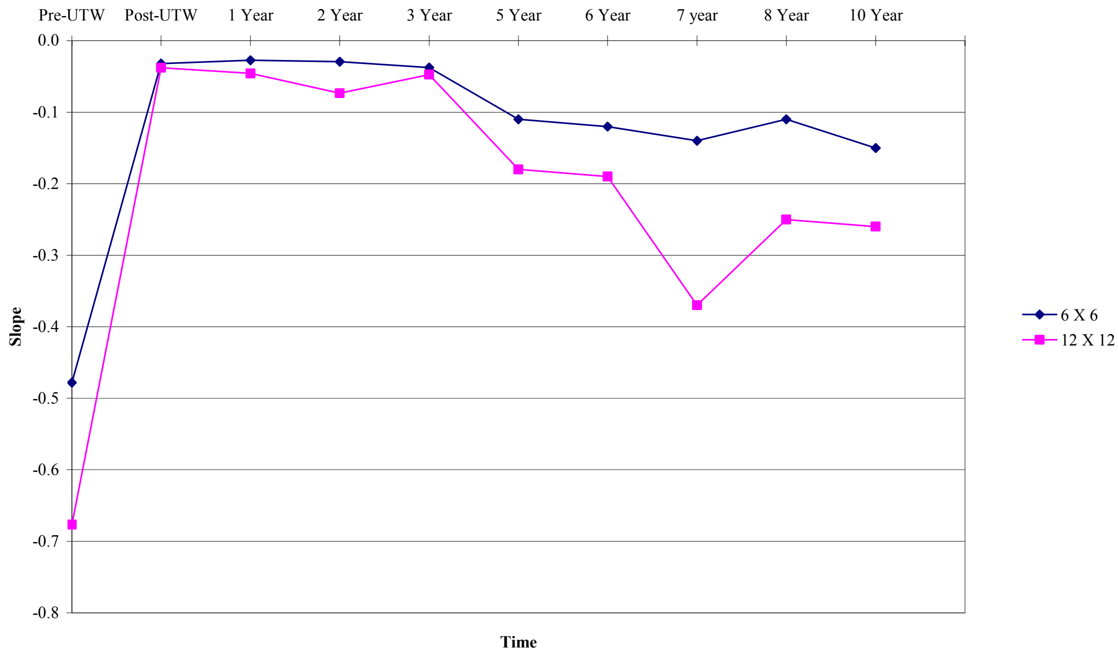


Figure C.11 Average slopes between D0 and D1 for various joint spacings with 7 inch PCC over time

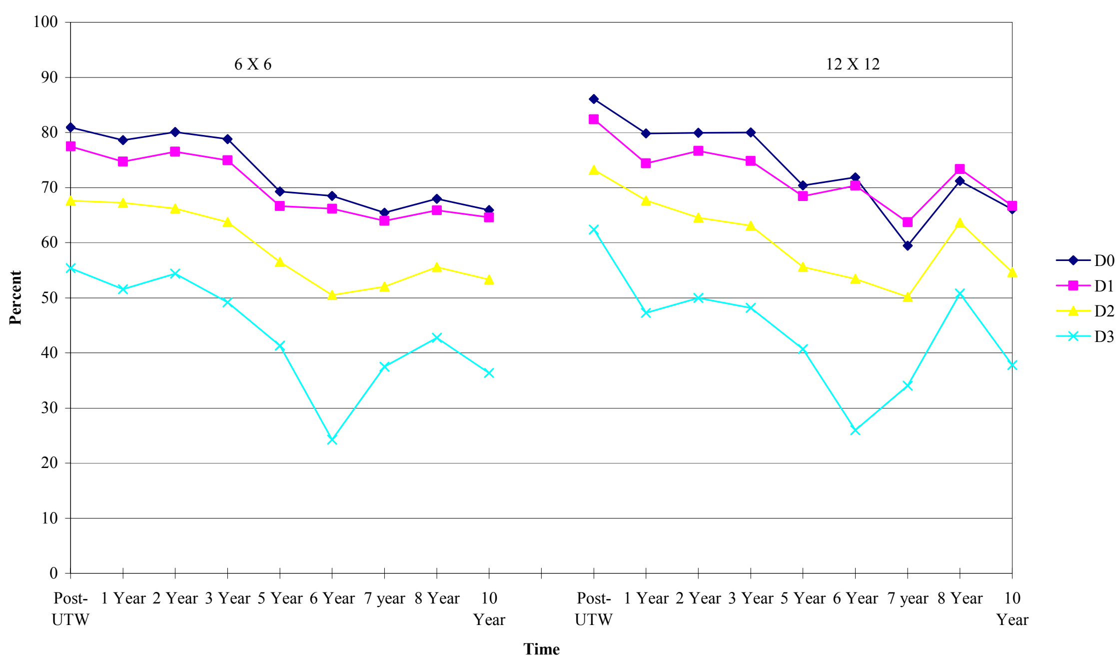


Figure C.12 Percent reduction in average deflections for various joint spacings with 7 inch PCC over time

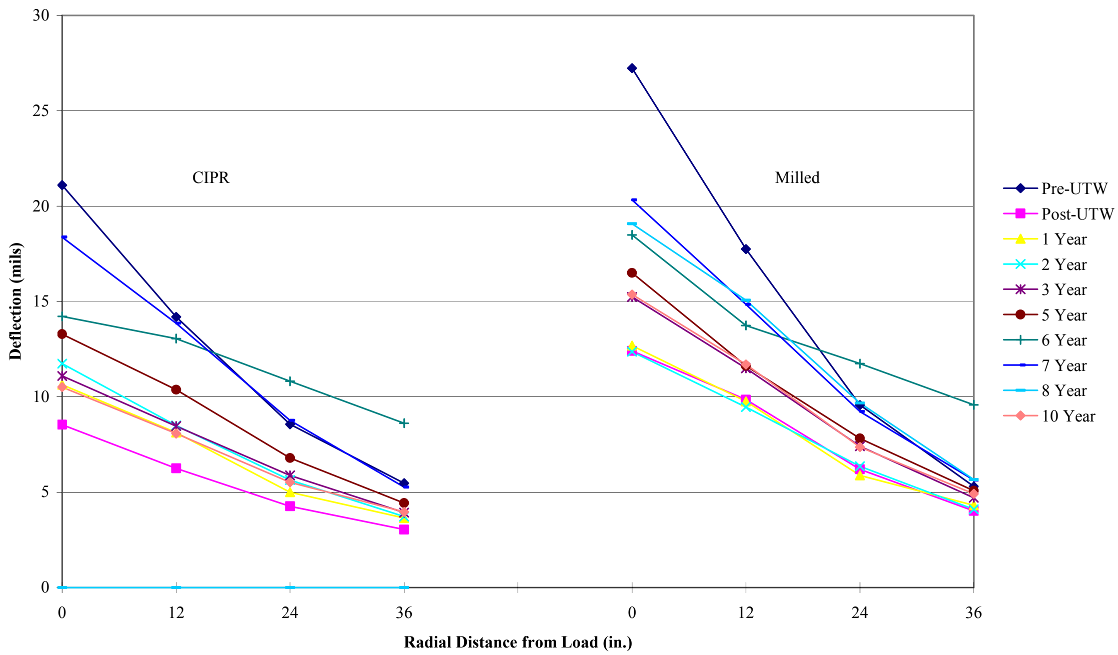


Figure C.13 Average deflection basins for various surface preparations with 3 inch PCC over time

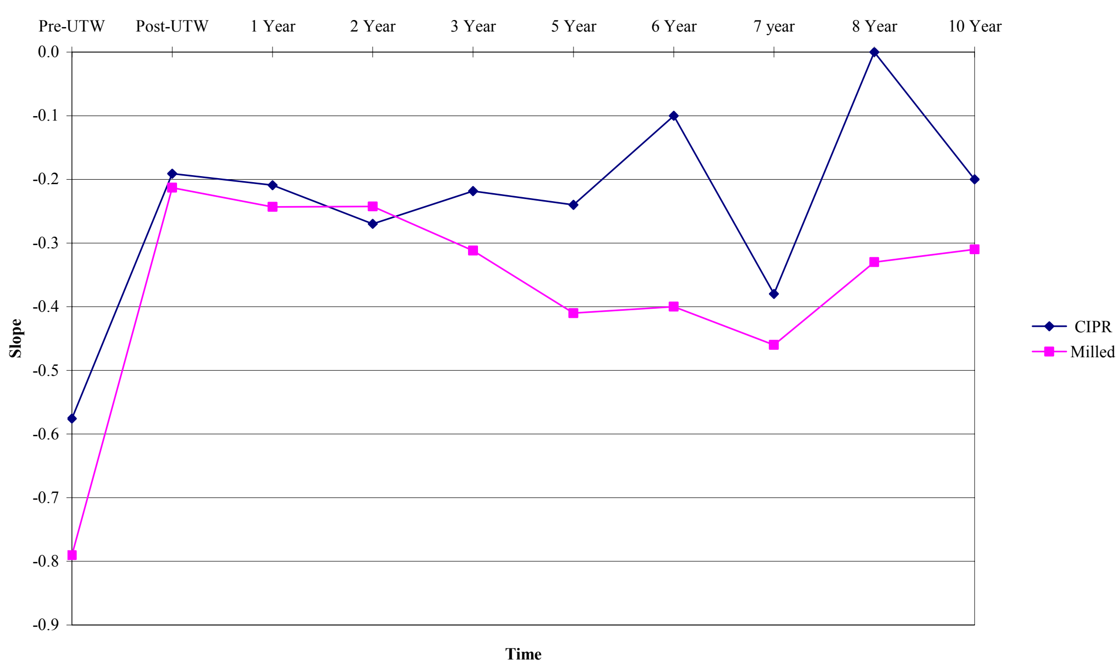


Figure C.14 Average slopes between D0 and D1 for various surface preparations with 3 inch PCC over time

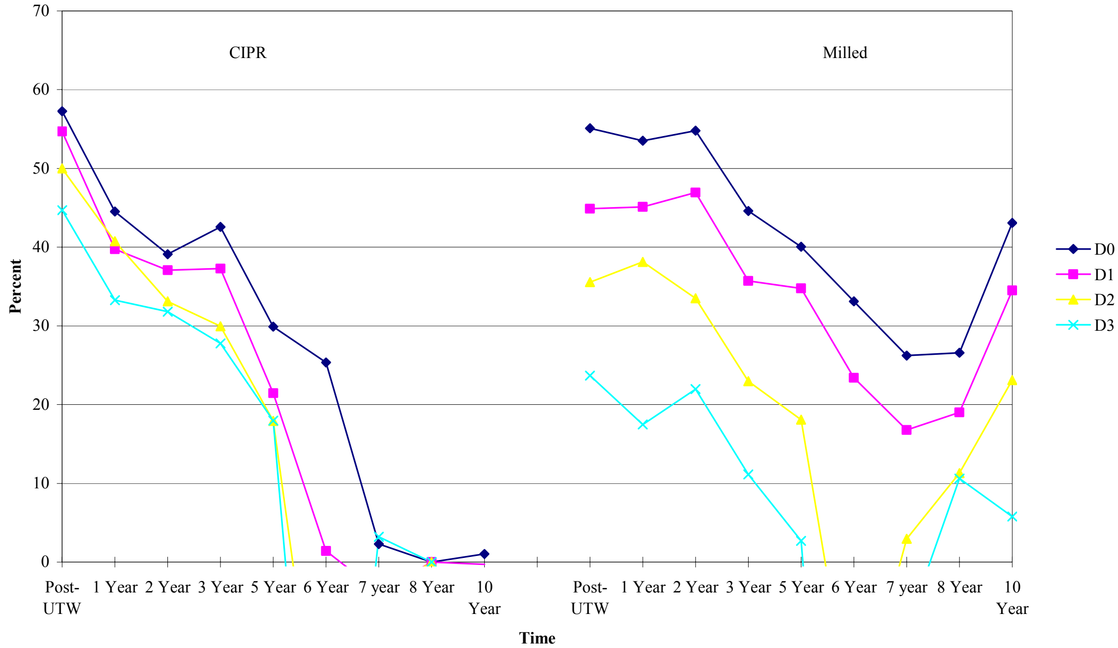


Figure C.15 Percent reduction in average deflections for various surface preparations with 3 inch PCC over time

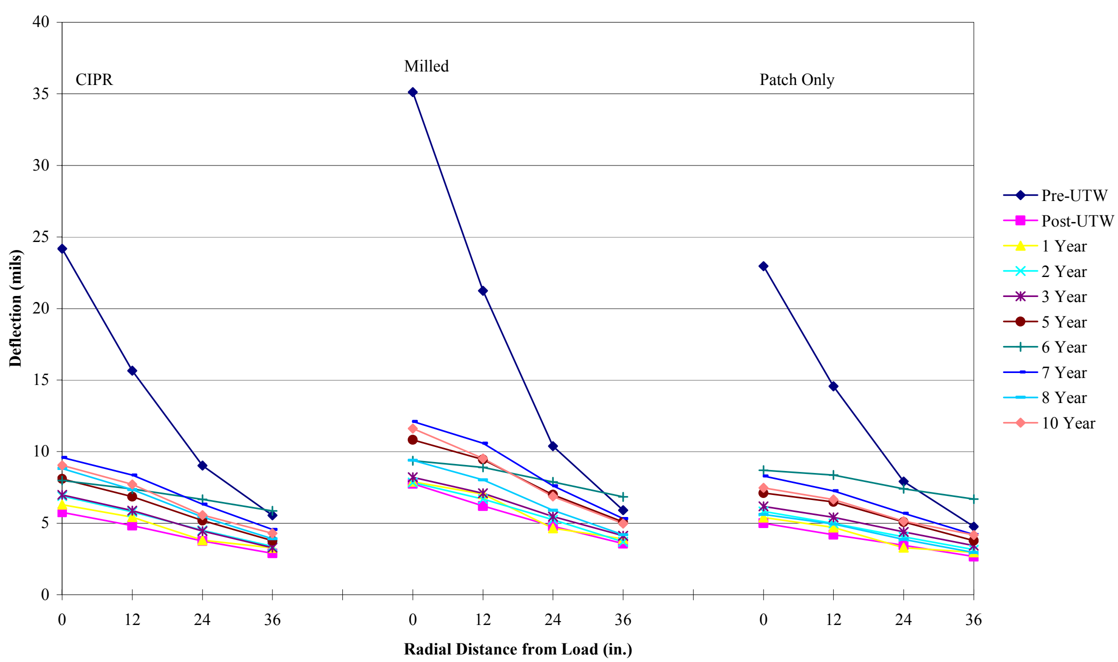


Figure C.16 Average deflection basins for various surface preparations with 5 inch PCC over time

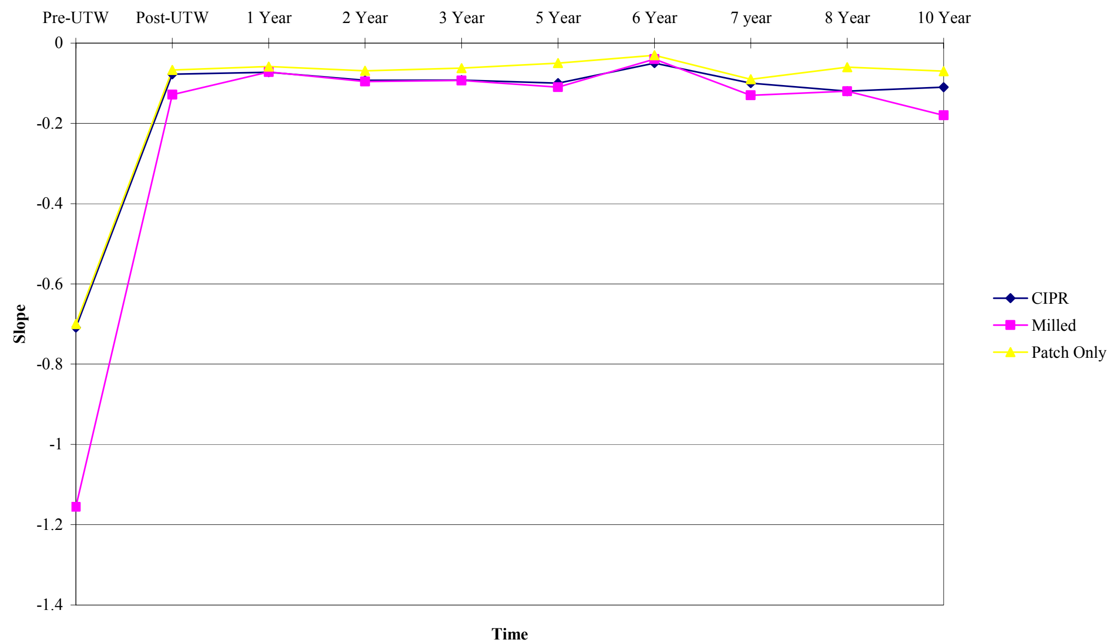


Figure C.17 Average slopes between D0 and D1 for various surface preparations with 5 inch PCC over time

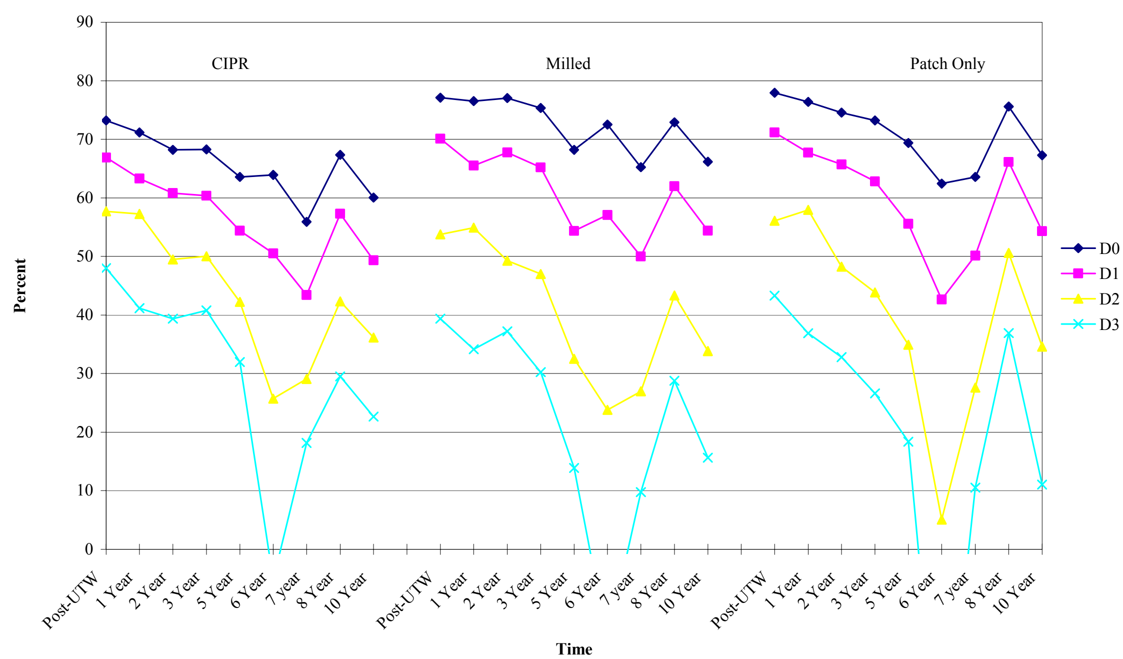


Figure C.18 Percent reduction in average deflections for various surface preparations with 5 inch PCC over time

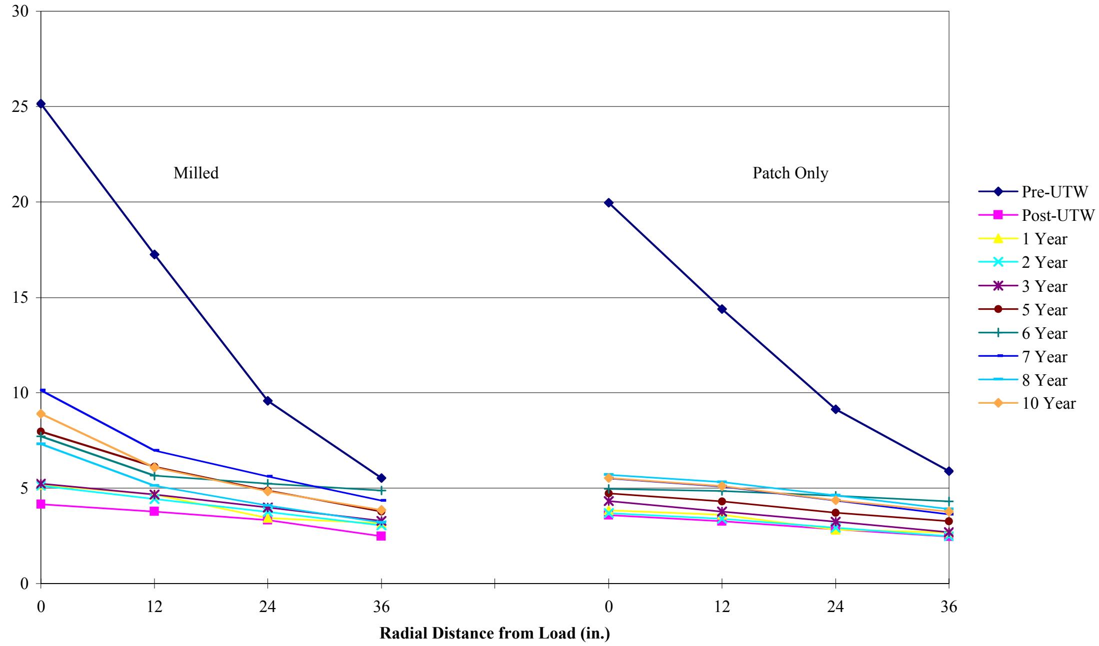


Figure C.19 Average deflection basins for various surface preparation with 7 inch PCC over time

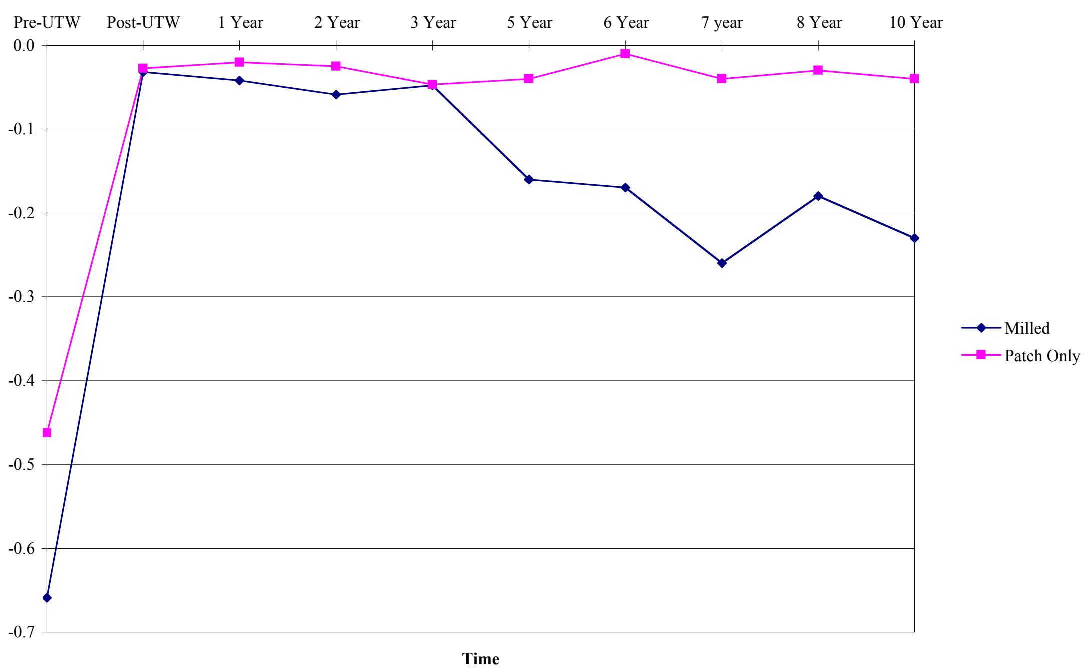


Figure C.20 Average slopes between D0 and D1 for various surface preparations with 7 inch PCC over time

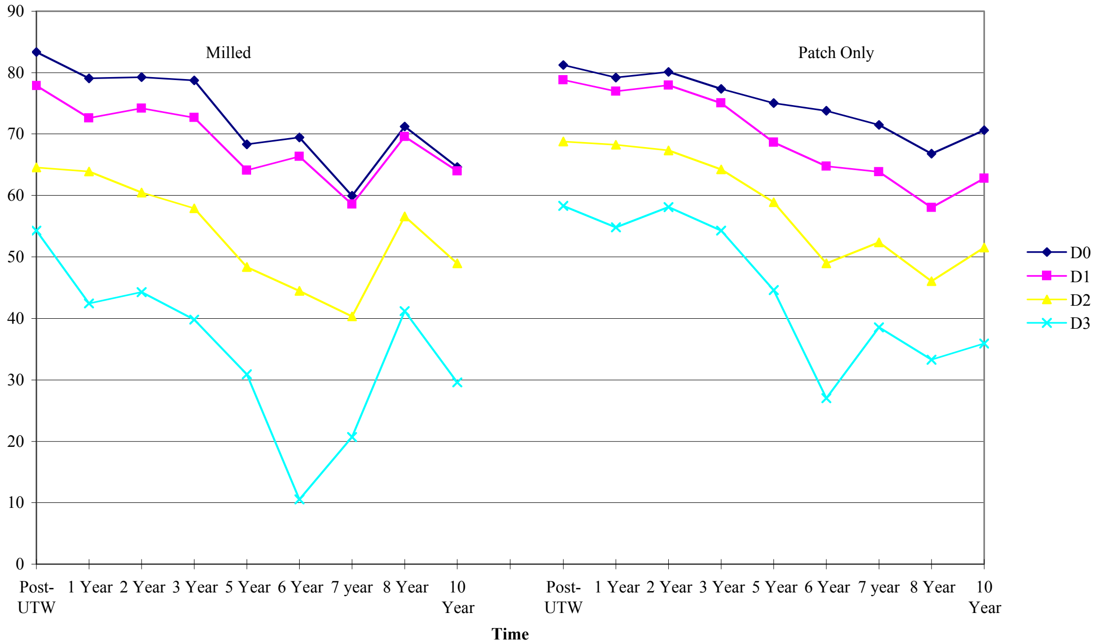


Figure C.21 Percent reduction in average deflections for various surface preparations with 7-inch PCC over time

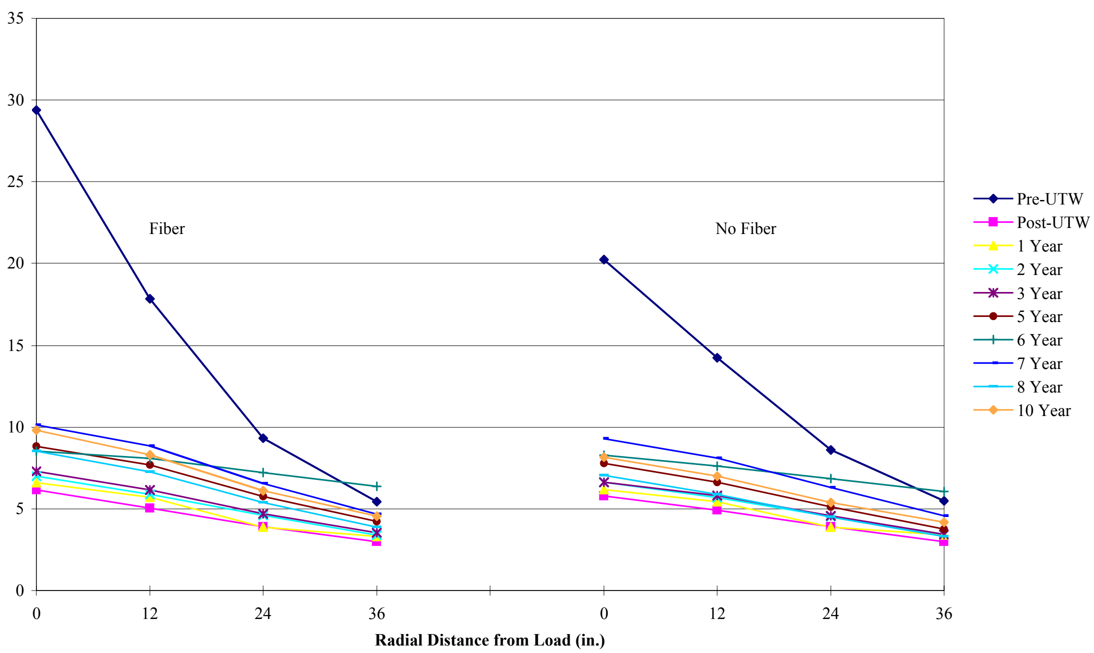


Figure C.22 Average deflection basins for various usage of synthetic fiber reinforcement with 5-inch PCC over time

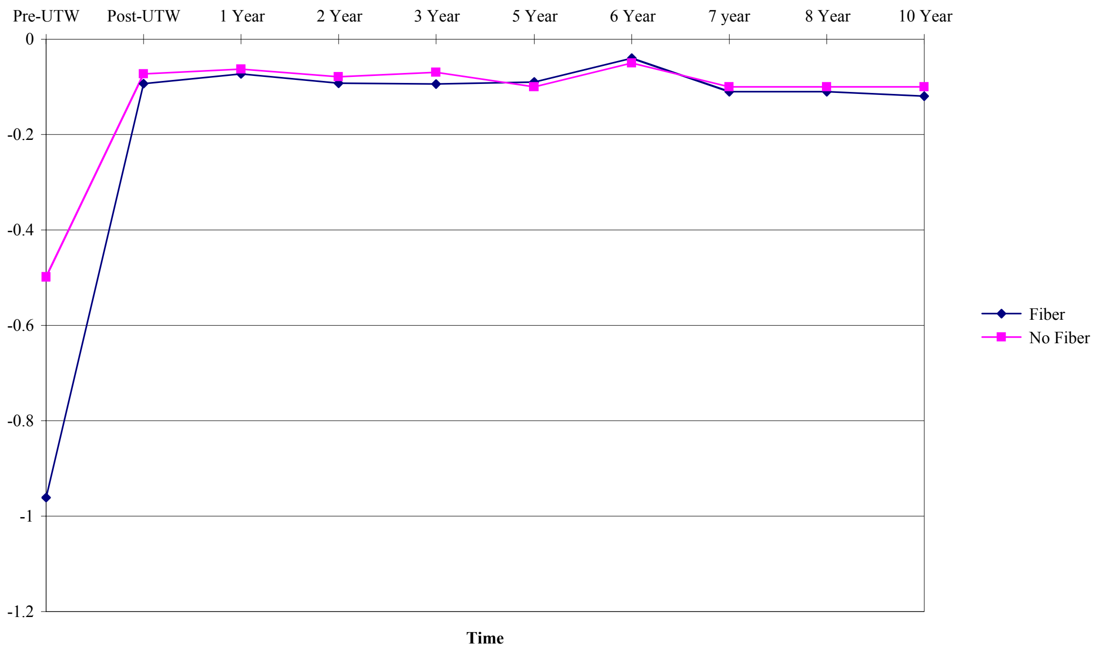


Figure C.23 Average slopes between D0 and D1 for various usage of synthetic fiber reinforcement with 5-inch PCC over time

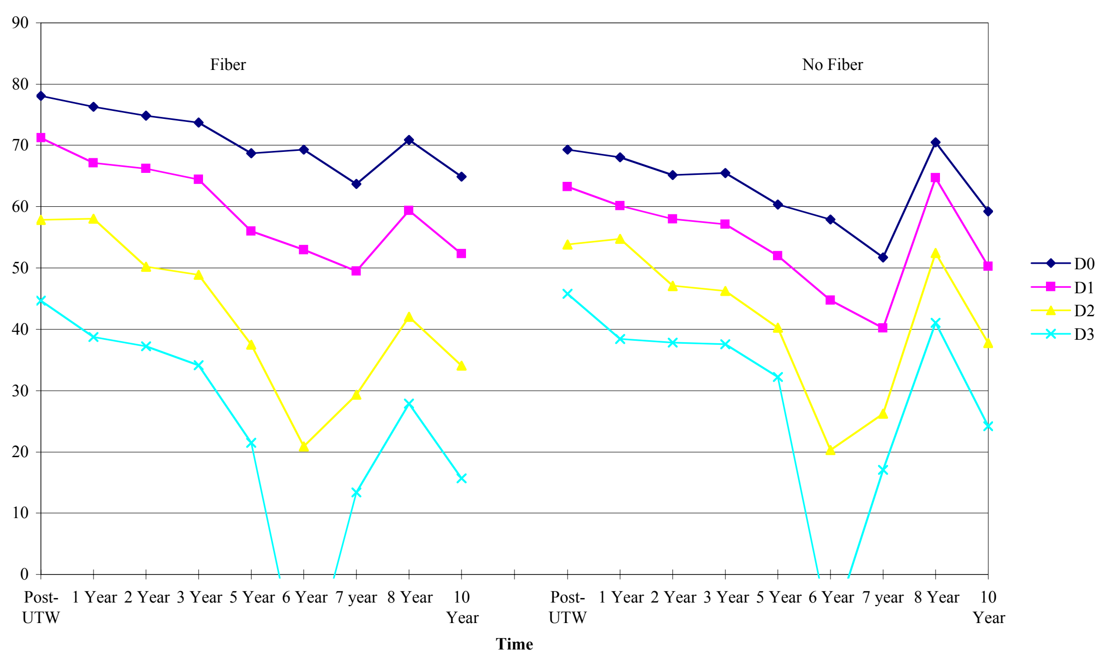


Figure C.24 Percent reduction in average deflections for various usage of synthetic fiber reinforcement with 5-inch PCC over time

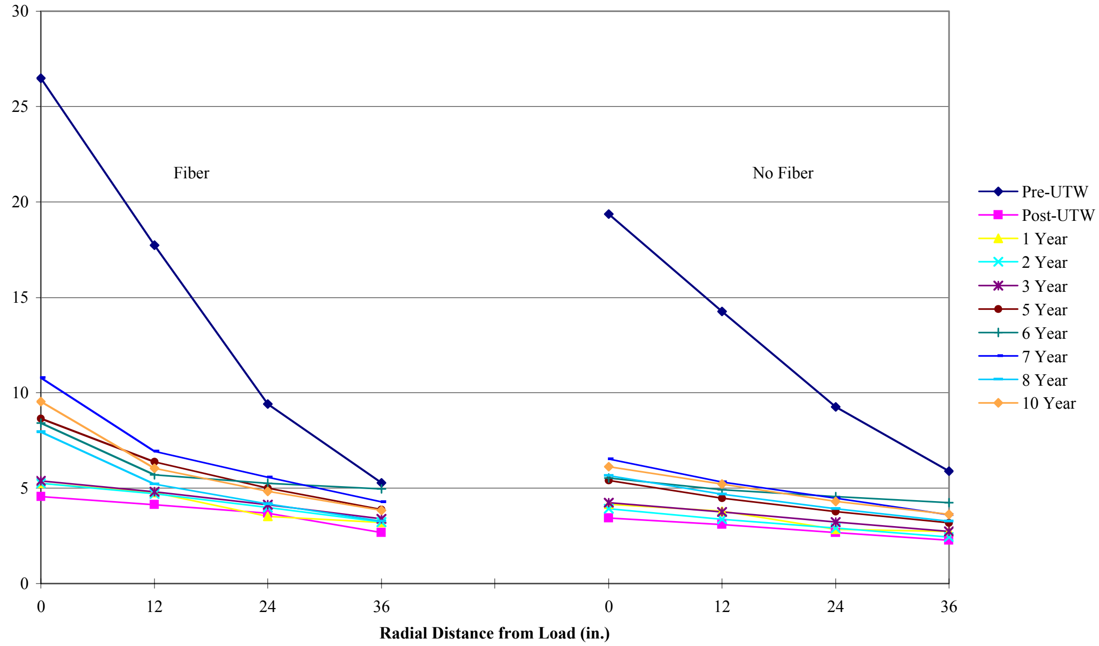


Figure C.25 Average deflection basins for various usage of synthetic fiber reinforcement with 7-inch PCC over time

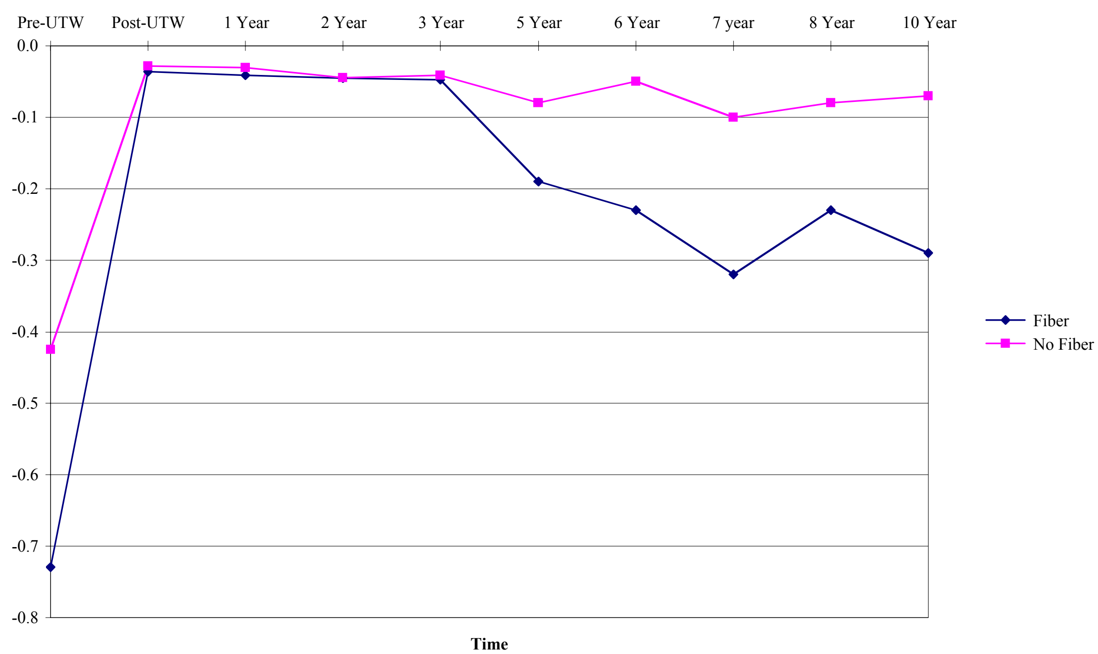


Figure C.26 Average slopes between D0 and D1 for various usage of synthetic fiber reinforcement with 7-inch PCC over time

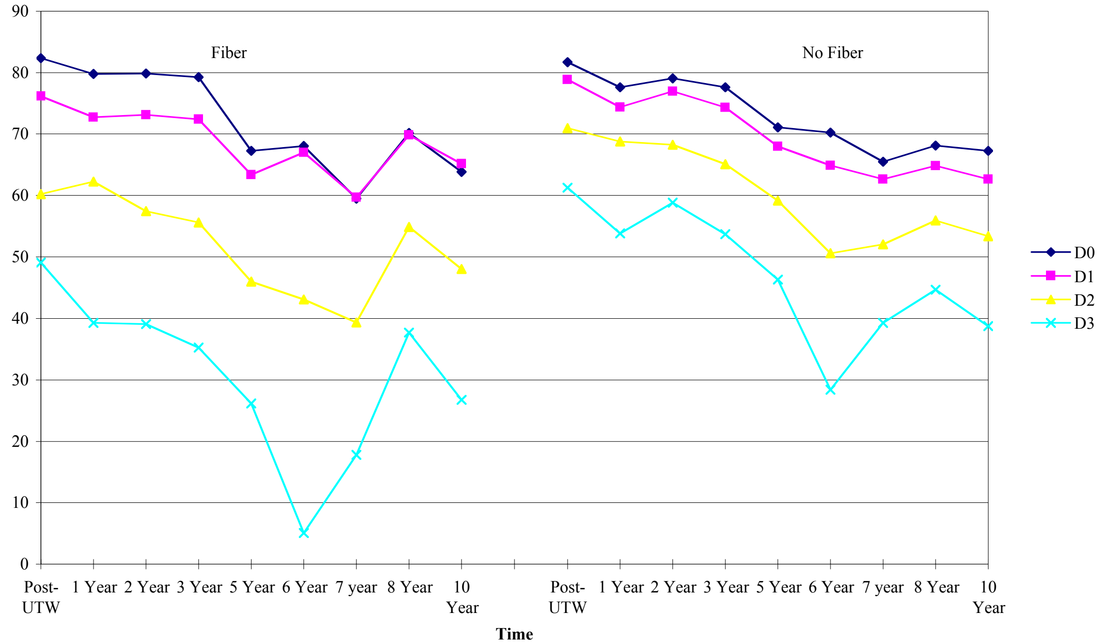
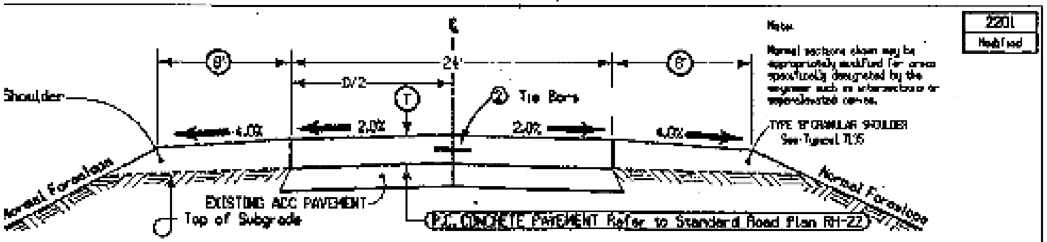


Figure C.27 Percent reduction in average deflections for various usage of synthetic fiber reinforcement with 7-inch PCC over time

APPENDIX D: TYPICAL PROJECT CROSS-SECTIONS



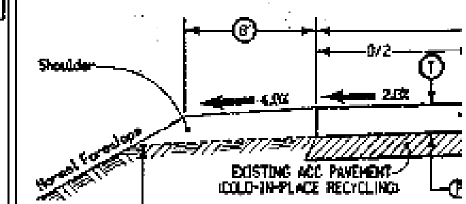
TYPICAL CROSS SECTION 2 LANE ROADWAY (PATCH & SCARIFY) OR (PATCH) WITH PCC OVERLAY

* NOT A BID ITEM

① Tons per side per station. See typical 7135.

② Use L-1 or L-2 tie bars, see RH-51.

STATION TO STATION		THICKNESS Ⓣ	FIBERS * F=Fibers NF=No Fibers	JOINT SPACING *	PER STATION QUANTITIES SCARIFY Sq.Yds.	PCC OVERLAY Sq.Yds.	PCC OVERLAY Cu.Yds.	TYPE 'B' SHOULDERS ① Tons	Joint Sealing	REMARKS
2335+64	2340	8"	Recomst.	20'	See Typicals 2207 & 7110					
2340	2342	8"-6" Trans.	NF-F	12'	266.67	266.67	51.85	37		
2342	2349	6"	F	12'	266.67	266.67	44.44	33		
2349	2356	6"	F	6'	266.67	266.67	44.44	33		
2356	2357	6"-4" Trans.	F	6'	266.67	266.67	37.04	28		
2357	2364	4"	F	6'	266.67	266.67	29.63	24	X	
2364	2371	4"	F	2'	266.67	266.67	29.63	24	X	
2371	2378	4"	F	4'	266.67	266.67	29.63	24		
2378	2380	4"-2" Trans.	F	2'	266.67	266.67	22.22	19		
2380	2387	2"	F	2'	266.67	266.67	14.82	15		
2387	2394	2"	F	4'	266.67	266.67	14.82	15		
2394	2396	2"-6" Trans.	F	4'-6'	266.67	266.67	29.63	24		
2396	2403	6"	F	6'	266.67	266.67	44.44	33		
2403	2414	6"	F	12'	266.67	266.67	44.44	33		
2414	2415	6"-4.5" Trans.	F	12'-6'	266.67	266.67	38.89	29		
2415	2425	See Typical 2602 for overlay information.			(4.5" ACC Overlay)			26		
2425	2426	4.5"-6" Trans.	NF	6'-12'	266.67	266.67	38.89	29		
2426	2433	6"	NF	12'	266.67	266.67	44.44	33		
2433	2440	6"	NF	6'	266.67	266.67	44.44	33		
2440	2441	6"-4" Trans.	NF	6'-2'	266.67	266.67	37.04	28		
2441	2448	4"	NF	2'	266.67	266.67	29.63	24		
2448	2449	4"-2" Trans.	NF	2'	266.67	266.67	22.22	19		
2449	2456	2"	NF	2'	266.67	266.67	14.82	15		
2456	2458	2"-6" Trans.	NF	2'-6'	266.67	266.67	29.63	24		
2458	2460	6"	NF	6'	266.67	266.67	44.44	33		
2460	2468	6"	NF	6'	---	266.67	44.44	33		
2468	2479	6"	NF	12'	---	266.67	44.44	33		
2479	2480	6"-4" Trans.	NF	12'-4'	---	266.67	37.04	28		
2480	2487	4"	NF	4'	---	266.67	29.63	24		
2487	2489	4"-8" Trans.	NF	4'-15'	---	266.67	44.44	33		
2489	2496	8"	NF	15'ND	---	266.67	59.26	42		
2496	2503	8"	NF	15'D	---	266.67	59.26	42		
2503	2505	8"-4.5" Trans.	NF	15'-6'	---	266.67	46.29	34		
2505	2515	See Typical 2602 for overlay information.			(4.5" ACC Overlay)			26		
2515	2516	4.5"-6" Trans.	NF	4'-12'	---	266.67	38.89	29		
2518	2538	6"	NF	6'	---	266.67	44.44	33	D	
2538	2540	6"-2" Trans.	NF-F	6'-2'	---	266.67	29.63	24		
2540	2547	2"	F	2'	---	266.67	14.82	15	X	
2547	2554	2"	F	4'	---	266.67	14.82	15	X	
2554	2555	2"-4" Trans.	F	4'	---	266.67	22.22	19		



TYPICAL CROSS SE[CTION] COLD-IN-PLA[CE] WITH PC[C]

* NOT A BID ITEM

AREA	STATION TO STATION		THICKNESS Ⓣ	FIBERS * F=Fibers NF=No Fibers	JOINT SPACING *	IN-PLACE RECYCLING Sq.
46.	2505	2593	6"	F	6'	266.67
47.	2593	2594	6"-4" Trans.	F	6'	266.67
48.	2594	2601	4"	F	6'	266.67
49.	2601	2608	4"	F	2'	266.67
50.	2608	2615	4"	F	4'	266.67
51.	2615	2616	4"-2" Trans.	F	4'-2'	266.67
52.	2616	2624	2"	F	2'	266.67
53.	2624	2631	2"	F	4'	266.67
54.	2631	2633	2"-6" Trans.	F-FN	4'-6'	266.67
55.	2633	2640	6"	NF	6'	266.67
56.	2640	2653	6"	NF	12'	266.67
57.	2653	2654	6"-4" Trans.	NF	12'-6'	266.67
58.	2654	2661	4"	NF	6'	266.67
59.	2661	2662	4"-5" Trans.	NF	6'-12'	266.67
60.	2662	2689	5"	NF	12'	266.67
61.	2689	2691	6"-2" Trans.	NF	12'-4'	266.67
62.	2691	2698	2"	NF	4'	266.67
63.	2698	2700	2"-6" Trans.	NF	4'-12'	266.67
64.	2700	2704	6"-4.5" Trans.	NF	12'-4'	266.67
65.	2704	2714+08	See Typical 2603 for ACC overlay			266.67

NOTE:
1) Areas of 4" or less P.C.C. overlay do not require centerl[ine]...
2) Areas of fibers in P.C.C. overlay do not require centerline...
3) Fibers will be incidental to bid item.
4) Joint spacing will be incidental to bid item.

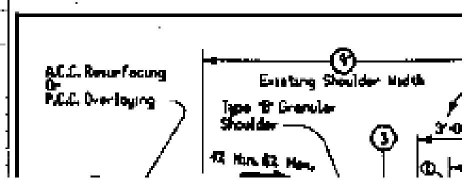
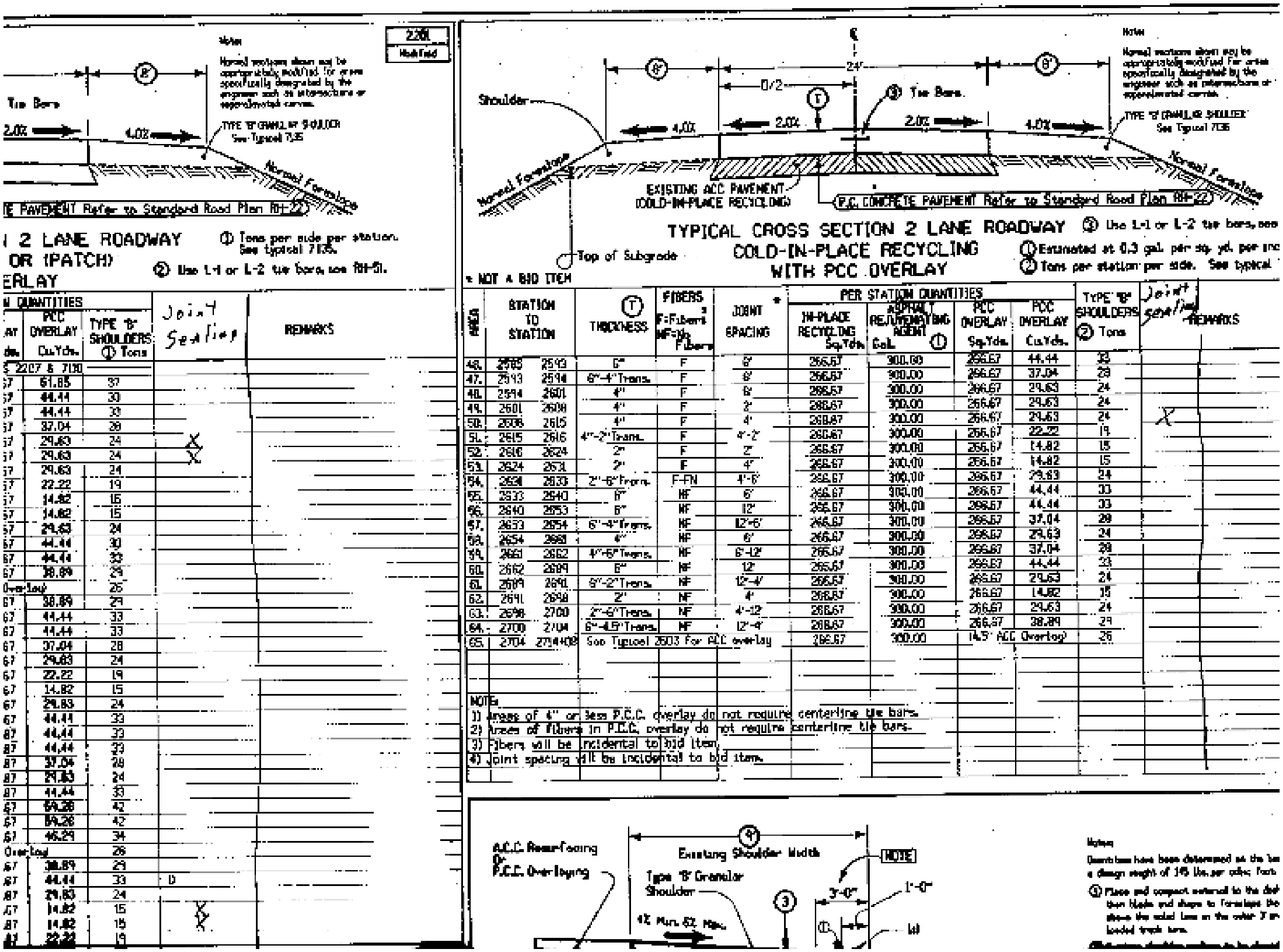


Figure D.1 Typical cross section patched or milled with PCC overlay



AREA	STATION TO STATION		Ⓣ THICKNESS	FIBERS F=Fibers NF=No Fibers	JOINT SPACING *	IN-PLACE RECYCLING Sq.Yds.	ASPHALT REJUVENATING AGENT Gal. ①	PCC OVERLAY Sq.Yds.	PCC OVERLAY Cu.Yds.	TYPE "B" SHOULDERS ② Tons	Joint sealing REMARKS
46.	2585	2593	6"	F	6'	266.67	300.00	266.67	44.44	33	
47.	2593	2594	6"-4" Trans.	F	6'	266.67	300.00	266.67	37.04	29	
48.	2594	2601	4"	F	6'	266.67	300.00	266.67	29.63	24	
49.	2601	2608	4"	F	2'	266.67	300.00	266.67	29.63	24	
50.	2608	2615	4"	F	4'	266.67	300.00	266.67	29.63	24	X
51.	2615	2616	4"-2" Trans.	F	4'-2'	266.67	300.00	266.67	22.22	19	
52.	2616	2624	2"	F	2'	266.67	300.00	266.67	14.82	15	
53.	2624	2631	2"	F	4'	266.67	300.00	266.67	14.82	15	
54.	2631	2633	2"-6" Trans.	F-FN	4'-6'	266.67	300.00	266.67	29.63	24	
55.	2633	2640	6"	NF	6'	266.67	300.00	266.67	44.44	33	
56.	2640	2653	6"	NF	12'	266.67	300.00	266.67	44.44	33	
57.	2653	2654	6"-4" Trans.	NF	12'-6'	266.67	300.00	266.67	37.04	29	
58.	2654	2661	4"	NF	6'	266.67	300.00	266.67	29.63	24	
59.	2661	2662	4"-6" Trans.	NF	6'-12'	266.67	300.00	266.67	37.04	29	
60.	2662	2689	6"	NF	12'	266.67	300.00	266.67	44.44	33	
61.	2689	2691	6"-2" Trans.	NF	12'-4'	266.67	300.00	266.67	29.63	24	
62.	2691	2698	2"	NF	4'	266.67	300.00	266.67	14.82	15	
63.	2698	2700	2"-6" Trans.	NF	4'-12'	266.67	300.00	266.67	29.63	24	
64.	2700	2704	6"-4.5" Trans.	NF	12'-4'	266.67	300.00	266.67	38.89	29	
65.	2704	2714+08	See Typical 2603 For ACC overlay			266.67	300.00	(4.5" ACC Overlay)		26	

NOTE:
1) Areas of 4" or less P.C.C. overlay do not require centerline tie bars.
2) Areas of fibers in P.C.C. overlay do not require centerline tie bars.
3) Fibers will be incidental to bid item.
4) Joint spacing will be incidental to bid item.

Figure D.2 Typical cross section cold in place recycling with PCC overlay

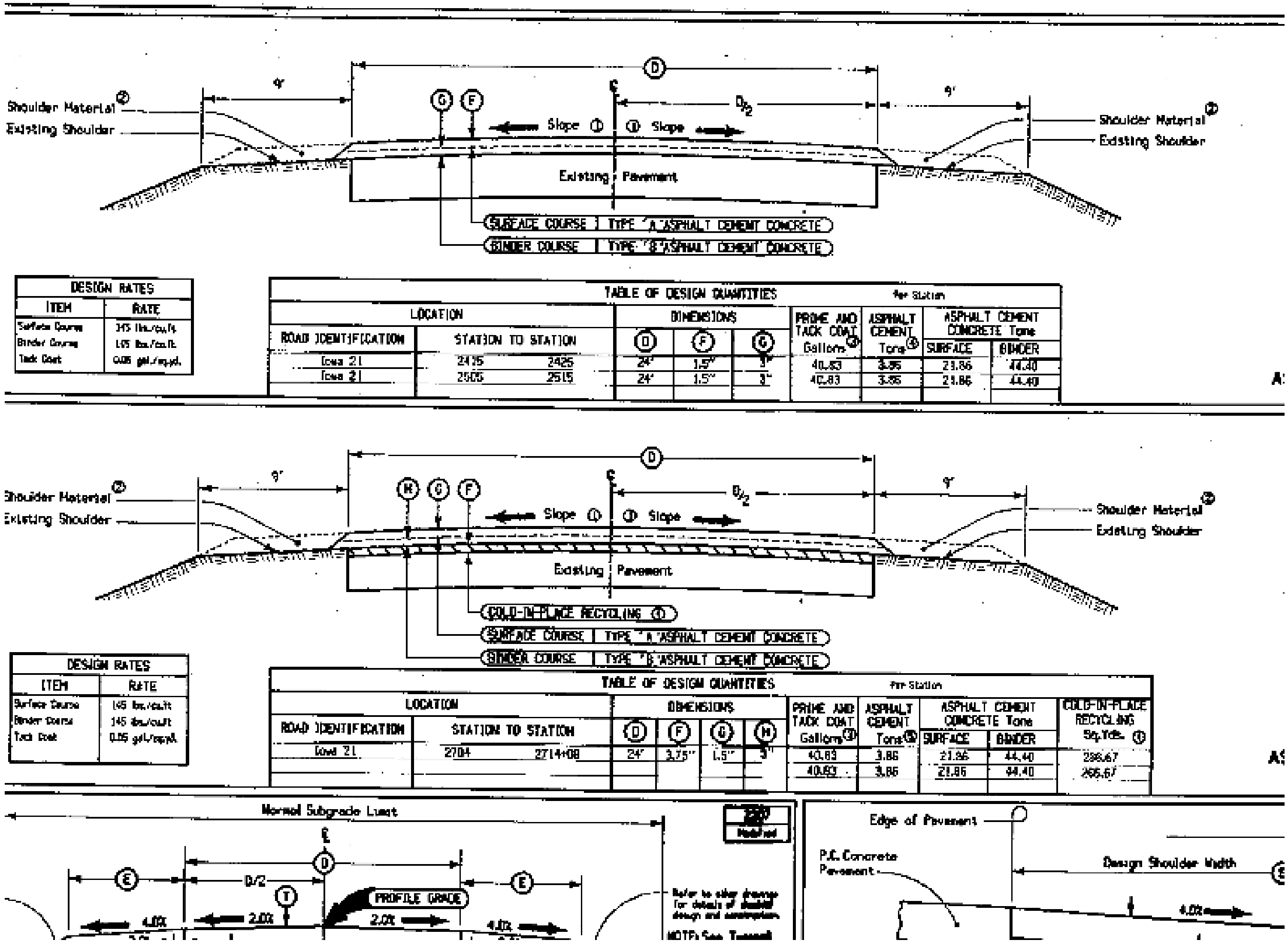


Figure D.3 Typical cross section asphalt cement concrete resurfacing