COST-EFFECTIVENESS OF CRACK SEALING MATERIALS AND TECHNIQUES FOR ASPHALT PAVEMENTS

Final Report

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16. Abstract
Sealing or filling cracked asphalt pavements to prevent the intrusion of water into the pavement structure has long been an accepted practice of the Montana Department of Transportation (MDT). The goals of this research are to establish the most economical and effective method of sealing pavement cracks for Montana; and to better determine the role of crack sealing within Montana's pavement management system (PvMS). This study has involved the construction of four experimental test sites within larger crack sealing projects. These test sites have included combinations of eleven sealant materials and six sealing techniques. Monitoring of the test sites includes visual inspections (for all of the sites) and nondestructive structural readings and surface distress identification under Montana's PvMS (for one test location). An estimate of the useful life of each crack sealing method has been determined from these investigations.

This report presents information on project history, the project methodology used for evaluating and analyzing the performance of sealed cracks, and the results of the cost-effectiveness analysis. Final results are presented for the four test sites: Conrad, Dutton, Tarkio, and Helena (Seiben). Results show that similar performance has been observed for all materials with ASTM D 5329 cone penetrations in excess of 90. In general, routing of transverse cracks improved the performance of the sealants. Routing does not appear necessary for centerline longitudinal cracks. Notably, router operators seem to prefer the shallow reservoir configuration as compared to square reservoirs.

The test site established near Helena provided the most reliable and useful data. As such, a detailed review of the final performance from four and a half years of service is summarized. In general, the highest failure rates occur during the coldest period of the year, and much of this distress exhibits a tendency to "heal" after exposure to the summer heat and traffic. An eclectic forecasting model has proven useful in predicting the life of crack sealing operations for those methods that did not show complete failure during the evaluation period. Structural evaluations using a Falling Weight Deflectometer did not prove an advantage for any particular sealing technique or sealing material nor did they prove the benefit of sealing cracks in asphalt pavements. Therefore, conducting a life-cycle cost analysis was impractical because no structural or ride benefit was proven at this site, however, a cost-effectiveness analysis was performed and the averaged results showed that, overall, Crafco 522 was the most cost-effective material and the Shallow and Flush was the most cost-effective fill technique. However, the crack sealing approach that has the highest cost-effectiveness as calculated herein (defined as the ratio of effectiveness to cost) may not offer the best value, if this effectiveness is in excess of that required to protect the pavement from premature damage. Therefore, even though the most cost-effective material and techniques have been determined, more research is necessary to substantiate the need for higher performance materials and techniques.

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DISCLAIMER

ALTERNATIVE FORMAT STATEMENT

NOTICE

ABSTRACT

Sealing or filling cracked asphalt pavements to prevent the intrusion of water into the pavement structure has long been an accepted practice of the Montana Department of Transportation (MDT). The goals of this research are to establish the most economical and effective method of sealing pavement cracks for Montana; and to better determine the role of crack sealing within Montana's pavement management system (PvMS). This study has involved the construction of four experimental test sites within larger crack sealing projects. These test sites have included combinations of eleven sealant materials and six sealing techniques. Monitoring of the test sites includes visual inspections (for all of the sites) and nondestructive structural readings and surface distress identification under Montana's PvMS (for one test location). An estimate of the useful life of each crack sealing method has been determined from these investigations.

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The test site established near Helena provided the most reliable and useful data. As such, a detailed review of the final performance from four and a half years of service is summarized. In general, the highest failure rates occur during the coldest period of the year, and much of this distress exhibits a tendency to "heal" after exposure to the summer heat and traffic. An eclectic forecasting model has proven useful in predicting the life of crack sealing operations for those methods that did not show complete failure during the evaluation period. Structural evaluations using a Falling Weight Deflectometer did not prove an advantage for any particular sealing technique or sealing material nor did they prove the benefit of sealing cracks in asphalt pavements. Therefore, conducting a life-cycle cost analysis was impractical because no structural or ride benefit was proven at this site, however, a cost-effectiveness analysis was performed and the averaged results showed that, overall, Crafco 522 was the most cost-effective material and the Shallow and Flush was the most cost-effective fill technique. However, the crack sealing approach that has the highest cost-effectiveness as calculated herein (defined as the ratio of effectiveness to cost) may not offer the best value, if this effectiveness is in excess of that required to protect the pavement from premature damage. Therefore, even though the most cost-effective material and techniques have been determined, more research is necessary to substantiate the need for higher performance materials and techniques.

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1 EXPERIMENTAL SETUP

The primary objective of this research was to determine the most economical and effective material(s) and method(s) for sealing cracks in flexible pavements in the state of Montana. This project evaluated four test sites through visual inspections of distresses, as well as structural monitoring (Helena site only) using a Falling Weight Deflectometer (FWD). This information has provided insight into the effect of crack sealing methods with regard to Montana's Pavement Management System (PvMS). An estimate of the useful life for each crack sealing method was determined by these evaluations which provided useful information regarding the use of crack sealing in Montana's PvMS. Several sealant materials and sealing techniques were included in this investigation.

1.1 Test Sites

Four experimental test sites were evaluated as part of this project. Figure 1 shows the general location of these test sites in Montana. Two of the four sites were in north-central Montana, on Interstate Highway 15: north of Conrad, Montana and north of Dutton, Montana. Cracks were sealed at the Conrad site on two dates, October 1995 and May 1996. Cracks at the Dutton site were sealed during July 1996. The remaining two test sites were located in west-central Montana: on Interstate Highway 15, north of Helena, Montana and in northwestern Montana on Interstate Highway 90, west of Tarkio, Montana. Cracks were sealed for these sites during July and August 1998, respectively. The Conrad, Dutton, Tarkio and Helena site evaluations were complete as of April 2001, June 2000, July 2001 and May 2003, respectively. Traffic conditions for the various sites are provided in Table 1.

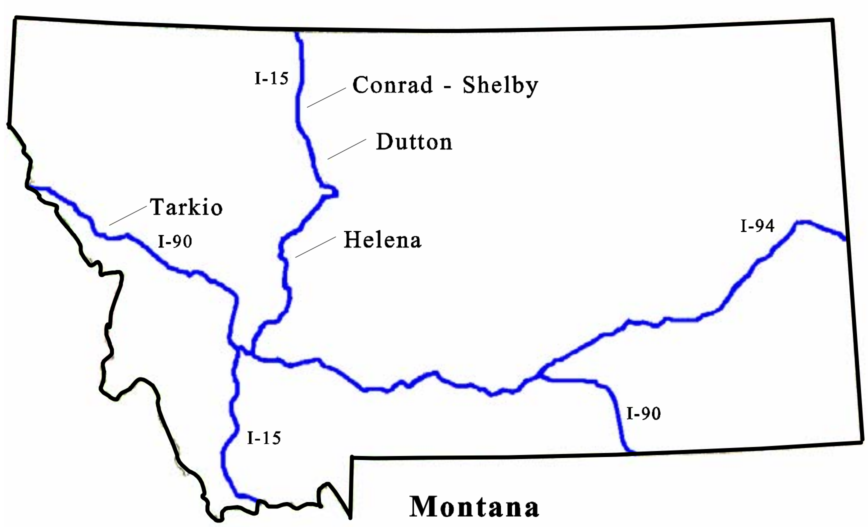

Figure 1: Location of Experimental Crack Sealing Sites within the State of Montana

Table 1: Summary of Traffic Volumes

Location	AADT *(vehicles/day)*								Averaged Data	
	1996	1997	1998	1999	2000	2001	2002	2003	AADT *(vehicles/day)*	Truck Traffic *(%)*
Conrad	2600	2690	2620	2690	2710	2730	---	---	2673	26
Dutton	3200	3200	3210	2850	2450	---	---	---	2982	26
Helena	---	---	3560	3610	3100	3500	3530	Data not available	3442	21
Tarkio	---	---	6450	6470	6490	6490	---	---	6475	25

A complete history of the weather for each of the four test sites was acquired from the National Climatic Data Center (NCDC, multiple years), and can be found in Appendix A. Table 2 shows average annual values for mean temperature, the number of days where the maximum temperature was above 90°F, number of days where the minimum temperature was below 0°F, and annual precipitation, for each of the test sites. Detailed weather information in Appendix A includes, but is not limited to, monthly and yearly:

- average temperature,
- departure from normal temperature,
- high and low temperature,
- precipitation values,
- departure from normal precipitation,
- number of days above 90°F,
- number of days below 32°F, and
- number of days below 0°F.

Table 2: Average Annual Weather Statistics

	Mean Temperature (°F)	Maximum > 90°F (*days*)	Minimum < 0°F (*days*)	Precipitation (*in.*)
Conrad (96-01)	44.6	20	29	9.0
Dutton (98-00)	44.4	10	15	10.5
Helena (98-02)	45.6	28.6	11.6	10.7
Tarkio (98-01)	48.2	42.5	2	19.5

1.2 Materials

Eleven materials were included in this study. Five materials were supplied by Crafco, Inc. (Chandler, AZ), but the sealant referred to as Crafco 299, is no longer in production. Two materials were supplied by Deery American Corporation (Grand Junction, CO), three materials were supplied by Maxwell Products Inc. (Cerritos, CA), and one material was supplied by the Witco Corporation (Chicago, IL). Most materials were single-component, hot-applied sealants.

One exception was the Witco material, which was a cold-pour emulsion. Material properties, as advertised by the manufacturers, are shown in Tables 3 and 4. Table 3 provides stiffness and resilience properties of the single cold-pour material (Witco CRF-MP) and Table 4 provides similar properties for the hot-pour materials.

Table 3: Properties for the Cold-Pour Materials as Advertised on the Manufacturer Data Sheet

Material	Saybolt Furol Viscosity[1] at 77°F (s)	Tests on Residue			
		Kinematic Viscosity[2] at 275°F (cSt)	Kinematic Viscosity[2] at 140°F (cSt)	Asphaltene Content[3] w%	Polymer Content[4] w%
Witco CRF-MP	**30 to 120**	**90 min.**	**7,000 to 12,000**	**9.5 max.**	**3.5 min.**

Test Methods:
1. Saybolt Furol Viscosity - ASTM D244
2. Kinematic Viscosity - ASTM D2170
3. Asphaltene Content - ASTM D2007
4. Polymer Content - Infrared Method (non-standardized test by Witco, Inc.)

Table 4: Properties for Hot-Pour Materials as Advertised on Manufacturer Data Sheets

Material	Cone Penetration (0.1 mm)	Modified Cone Penetration (0.1 mm)	Flow (mm)	Resilience (%)	Bond (pass 3 cycles)	Softening Point (ºC)	Recom-mended Application Temp. (ºC)
Crafco 221	90 max.	no data	3 max.	60% min.	-29ºC, 50%	no data	190
Crafco 231	90 to 150	no data	3 max.	60% min.	-29ºC, 200%	no data	190
Crafco 299	110 to 160	40 min.	10 max.	25 to 50%	-29ºC, 200%	no data	190
Crafco 516	50 to 80	no data	no data	30% min.	no data	77 min.	190
Crafco 522	100 to 150	25 min.	10 max.	30 to 60%	-29ºC, 200%	no data	190
Deery 101 ELT	100 to 150	25 min.	10 max.	30 to 60%	-29ºC, 200%	no data	190
Deery 1101	150 max.	no data	3 max.	60% min.	-29ºC, 200%	85 min.	190
Maxwell 60	150 max.	no data	3 max.	60% min.	-18ºC, 100%	88 min.	190 to 205
Maxwell 71	90 to 150	no data	3 max.	no data	-29ºC, 200%	77 min.	190 to 205
Maxwell 72	100 to 150	25 min.	10 max.	30 to 60%	-29ºC, 200%	no data	190 to 205

Test Descriptions:
- **Cone Penetration** (ASTM D 3405, D 5329): non-immersed, at 25°C (77°F), 150 g moving mass, 5 s
- **Modified Cone Penetration** (modified ASTM D 5329): non-immersed, at -18°C (0°F), 150 g moving mass, 5 s
- **Flow** (ASTM D 3405, D 5329): 60°C (140°F), specimen at 75 degrees from horizontal for 5 h
- **Resilience** (ASTM D 3405, D 5329): 25°C (77°F), 0.670 in. diameter sphere, 75 g moving mass, 20s recovery
- **Bond** (ASTM D 3405, D 5329): non-immersed, at -29°C (-20°F), percentage is extension from initial width of ¼ in.
- **Softening Point** (ASTM D 36): ring-and-ball apparatus, temperature rise of 5°C (9°F) per minute

1.3 Sealing Techniques

Sealing techniques included both non-routed and routed methods. Non-routed methods consisted of the Simple Band-Aid and Capped configurations. The Band-Aid configuration used a V-shaped or U-shaped squeegee to spread the sealant, and the capped configuration was accomplished by overfilling the crack slightly and allowing the excess sealant to settle. Routed methods included a "square" reservoir and a "shallow" reservoir. Square reservoirs have historically been the standard for the Montana Department of Transportation (MDT). Shallow reservoirs, otherwise known as Canada's 4-to-1 reservoirs, were included in this study because of reported advantages (Ponniah, 1992). This configuration is now considered the standard for MDT. Recent modifications in this technique have resulted in a 3-to-1 configuration. Shallow reservoirs were filled until the sealant was flush with the pavement surface. Square reservoirs were filled using three techniques: Flush, Recessed, or Band-Aid. These six techniques are detailed in Figure 2.

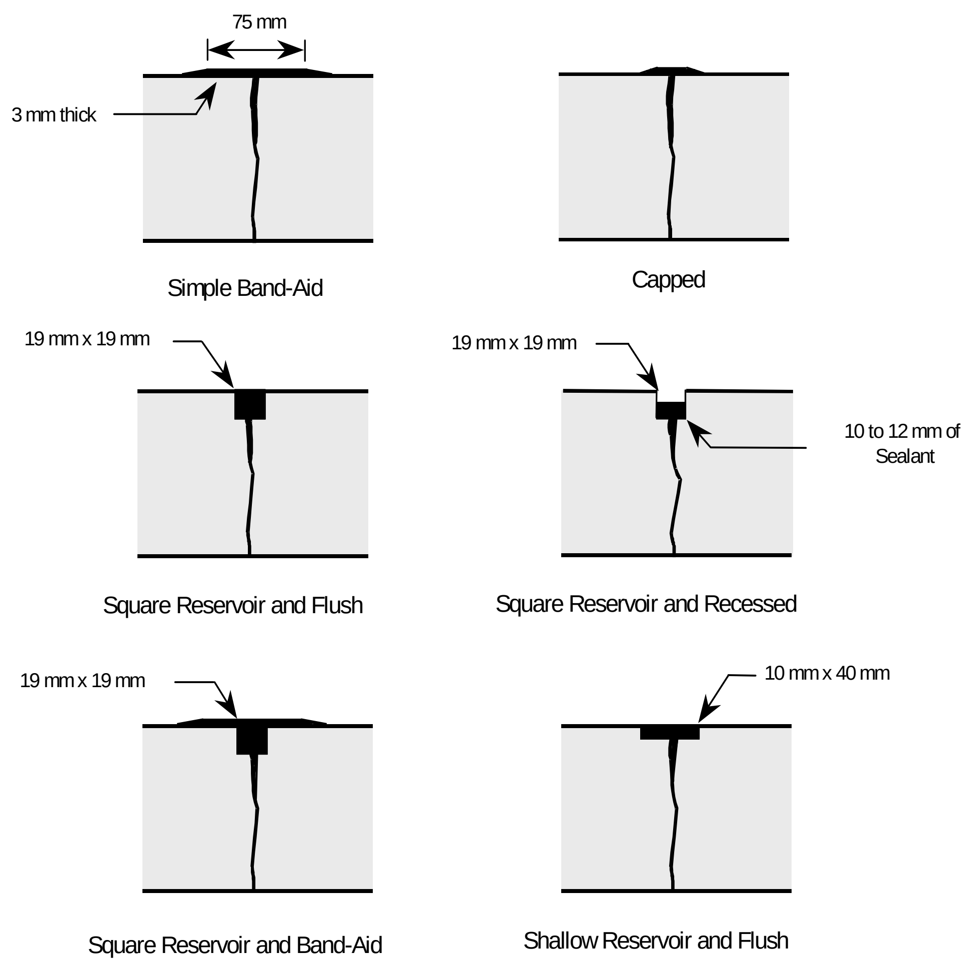

Figure 2: Crack Sealing Techniques

Square reservoirs were specified to be 3/4 x 3/4 inches (19mm x 19mm), for most of the test sections. However, on the Conrad project, square reservoirs were specified to be 5/8 x 3/4 inches (16mm x 19mm). This difference was not considered significant and was disregarded in the analysis. For most of the test sections, shallow reservoirs were specified to be 1-1/2 x 3/8 inches (40mm x 10mm). However, on the Dutton project, shallow reservoirs were specified to be 1-1/4 x 3/8 inches (32mm x 10mm). This also was considered insignificant and was not considered in the analysis.

1.4 Construction of Test Sites

The Conrad site used five materials and six sealing techniques. Table 5 provides a profile of the various material-to-technique combinations included at this site. Most of the test sections with Crafco 221 and Maxwell 60 were sealed in October 1995. One exception was the Maxwell 60 test section with the shallow reservoir, which was sealed in May 1996. The remaining test sections, including Deery 1101, Crafco 231, and Witco CRF-MP, were also sealed in May 1996. During this second phase of construction, any new cracks or sealant failures in the Crafco 221 or Maxwell 60 test sections were sealed or capped, respectively. These corrections to the Crafco 221 and Maxwell 60 sections were performed with the respective materials. Therefore, this entire test site will be considered as constructed in May 1996. In the Crafco 221 and Maxwell 60 test sections, only the portions of cracks with the appropriate sealing technique have been included in the evaluations.

Overall, the workmanship in Conrad was poor. Some materials were placed just prior to rain or were placed soon after rain, while the pavement was still moist, having visible dirt and/or debris in the crack. Construction practices, while not ideal, were consistent across all sections. Therefore, this provides an indication of performance following poor construction. Two materials failed extremely early: Deery 1101 and Witco CRF-MP. These failures are attributed primarily to poor construction. These two materials were not included in the analysis. Field evaluations were suspended for these sections after their failure.

Table 5: Crack Sealing Experiment - Interstate 15 North of Conrad, MT

Section	Mileposts BEG	Mileposts END	Material	Technique
A1	354.3	354.5	Crafco Roadsaver 221	Square Reservoir and Flush
A2	354.5	354.7		Square Reservoir and Band-Aid
A3	354.7	354.9		Simple Band-Aid
A4	354.9	355.1		Square Reservoir and Recess
A5	355.1	355.3		Capped
T1	355.3	355.4	Transition from Crafco 221 to Maxwell 60	Square Reservoir and Flush
B1	355.4	355.6	Maxwell Elastoflex 60	Square Reservoir and Flush
B2	355.6	355.8		Square Reservoir and Band-Aid
B3	355.8	356.0		Simple Band-Aid
B4	356.0	356.2		Square Reservoir and Recess
B5	356.2	356.4		Capped
B6	356.4	356.6		Shallow Reservoir and Flush
T2	356.6	356.7	Transition from Maxwell 60 to Deery 1101	Square Reservoir and Flush
C1	356.7	356.9	Deery 1101	Square Reservoir and Flush
C2	356.9	357.1		Square Reservoir and Band-Aid
C3	357.1	357.3		Simple Band-Aid
C4	357.3	357.5		Square Reservoir and Recess
C5	357.5	357.7		Capped
C6	357.7	357.9		Shallow Reservoir and Flush
T3	357.9	358.0	Transition from Deery 1101 to Crafco 231	Square Reservoir and Flush
D1	358.0	358.2	Crafco Roadsaver 231	Square Reservoir and Flush
D2	358.2	358.4		Square Reservoir and Band-Aid
D3	358.4	358.6		Simple Band-Aid
D4	358.6	358.8		Square Reservoir and Recess
D5	358.8	359.0		Capped
D6	359.0	359.2		Shallow Reservoir and Flush
T4	359.2	359.3	Transition from Crafco 231 to Witco CRF-MP	Square Reservoir and Flush
E1	359.3	359.5	Witco CRF-MP	Square Reservoir and Flush
E2	359.5	359.7		Square Reservoir and Band-Aid
E3	359.7	359.9		Simple Band-Aid
E4	359.9	360.1		Square Reservoir and Recess
E5	360.1	360.3		Capped
E6	360.3	360.5		Shallow Reservoir and Flush

Notes:
- Square reservoir was 5/8" x 3/4" deep.
- Shallow reservoir was 1-1/2" x 3/8" deep.
- Flush and Band-Aids were achieved with a V-shaped squeegee.
- Standard project crack sealing involved the placement of Crafco 231 in square reservoirs and the use of a V-shaped squeegee to strike the material flush.
- Crack sealing for MP 354.3 through MP 356.4 was performed in October 1995. Crack sealing for MP 356.4 through MP 360.5 was performed from 21 May 1996 through 31 May 1996. During this second phase of construction, all new cracks and reappearing cracks for MP 354.3 through MP 356.4 were sealed and resealed, respectively.

The Dutton site utilized four materials and two sealing techniques. Table 6 provides the details regarding these material/technique combinations for the Dutton site. Representatives from Crafco, Inc. placed these test sections in July 1996. There were no Western Transportation Institute (WTI) personnel present during construction. Later that year, MDT requested that WTI begin monitoring the performance of sealed cracks at this site. Based on an evaluation performed one year after construction, the workmanship at the Dutton site appeared to be adequate. However, the reported location of Crafco 516 among the routed square reservoirs was noticeably incorrect. This mistake was easily detected because the Crafco 516 material is much stiffer than the other three materials. The correct location of Crafco 516 is given in Table 6. It was also thought that Crafco 299 was used in the test section, when originally it was scheduled to receive Crafco 516. However, this could not be proven.

Table 6: Crack Sealing Experiment - Interstate 15 North of Dutton, MT

Section	Approximate Milepost		Material	Technique
	BEG.	END		
A1	316.8	316.5	Crafco Roadsaver 299	Shallow Reservoir and Flush
A2	316.5	316.3	Crafco 516	
A3	316.3	316.1	Crafco 522	
A4	316.1	315.9	Crafco Roadsaver 231	
B1	315.9	315.8	Crafco 516	Square Reservoir and Flush
B2	315.8	315.7	Crafco Roadsaver 299	
B3	315.7	315.5	Crafco 522	
B4	315.5	315.3	Crafco Roadsaver 231	

Notes:
- Square reservoir was 3/4" x 3/4".
- Shallow reservoir was 1-1/4" x 3/8" deep.
- Flush was achieved with a squeegee.
- Crack sealing was performed from July 15, 1996 through July 16, 1996.

The top course of pavement at the Dutton site utilized an open-graded mix design. The depth of the routing did not fully penetrate the depth of this layer. This is worthy of attention because open-graded friction courses are designed to allow water to flow through them to drain water from the road surface. This allowed water to interact with the sealant materials from all sides rather than just the top and bottom.

The Tarkio site utilized four materials and five sealing techniques. Table 7 provides the details of material and technique combinations. This test site was the first to include a control section, within which cracks were left unsealed. Sealing operations for this site were performed in July 1998. Workmanship was very good, but the site contained a limited number of cracks. Several test sections had neither transverse cracks nor longitudinal cracks making it difficult to have a representative statistical sample by which to analyze.

Table 7: Crack Sealing Experiment - Interstate 90 West of Tarkio, MT

Section	Approximate Milepost		Material	Technique
	BEG.	END		
A	61.5	61.3	Control Section	No Routing or Sealing
T1	61.3	61.2	Transition from Control to Crafco 231	Shallow Reservoir and Flush
B1	61.2	61.0	Crafco Roadsaver 231	Shallow Reservoir and Flush
B2	61.0	60.8		Square Reservoir and Recess
B3	60.8	60.6		Simple Band-Aid
B4	60.6	60.4		Square Reservoir and Band-Aid
B5	60.4	60.2		Square Reservoir and Flush
T2	60.2	60.1	Transition from Crafco 231 to Crafco 522	Shallow Reservoir and Flush
C1	60.1	59.9	Crafco 522	Shallow Reservoir and Flush
C2	59.9	59.7		Square Reservoir and Recess
C3	59.7	59.5		Simple Band-Aid
C4	59.5	59.3		Square Reservoir and Band-Aid
C5	59.3	59.1		Square Reservoir and Flush
T3	59.1	59.0	Transition from Crafco 522 to Maxwell 72	Shallow Reservoir and Flush
D1	59.0	58.8	Maxwell Elastoflex 72	Shallow Reservoir and Flush
D2	58.8	58.6		Square Reservoir and Recess
D3	58.6	58.4		Simple Band-Aid
D4	58.4	58.2		Square Reservoir and Band-Aid
D5	58.2	58.0		Square Reservoir and Flush
T4	58.0	57.9	Transition from Maxwell 72 to Crafco 221	Shallow Reservoir and Flush
E1	57.9	57.7	Crafco Roadsaver 221	Shallow Reservoir and Flush
E2	57.7	57.5		Square Reservoir and Recess
E3	57.5	57.3		Simple Band-Aid
E4	57.3	57.1		Square Reservoir and Band-Aid
E5	57.1	56.9		Square Reservoir and Flush

Notes:
- Square reservoir was 3/4" x 3/4".
- Shallow reservoir was 1-1/2" x 3/8" deep.
- Band-aids were achieved with a U-shaped squeegee.
- Flush, for items with Crafco 522, was achieved with a V-shaped squeegee.
- Flush, for the other experimental items, was achieved without a squeegee.
- Crack sealing was preformed from July 7, 1998 through July 9, 1998.

Five materials, five sealing techniques, and a non-routed, unsealed, control section were used at the Helena test site. Table 8 provides the details regarding the material and technique combinations used. Sealing for this test site was performed in August 1998. Workmanship at this site was also very good. The project contractor completely sealed all test sections, in Helena and Tarkio, with the exception of the section utilizing Crafco 231 sealant. For this test section Crafco, Inc. used their own melting pot and wand operator, while the project contractor still routed, squeegeed, and placed blotting material. Crafco's workmanship was inferior to the project contractor's, but it was sufficient to provide accurate comparisons between materials.

Table 8: Crack Sealing Experiment - Interstate 15 North of Helena, MT

Section	Milepost		Material	Techniques
	BEG.	END		
T1	216.0	215.8	Transition from Standard Project Crack Sealing Material to Deery 101	Shallow Reservoir and Flush
A1	215.8	215.6	Deery CMC 101 ELT	Square Reservoir and Flush
A2	215.6	215.4		Shallow Reservoir and Flush
A3	215.4	215.2		Square Reservoir and Band-Aid
A4	215.2	215.0		Square Reservoir and Recess
A5	215.0	214.8		Simple Band-Aid
T2	214.8	214.6	Transition from Deery 101 to Crafco 231	Shallow Reservoir and Flush
B1	214.6	214.4	Crafco Roadsaver 231	Shallow Reservoir and Flush
B2	214.4	214.2		Square Reservoir and Band-Aid
B3	214.2	214.0		Simple Band-Aid
B4	214.0	213.8		Square Reservoir and Flush
B5	213.8	213.6		Square Reservoir and Recess
T3	213.6	213.4	Transition from Crafco 231 to Maxwell 71	Shallow Reservoir and Flush
C1	213.4	213.2	Maxwell Elastoflex 72	Square Reservoir and Band-Aid
C2	213.2	213.0		Shallow Reservoir and Flush
C3	213.0	212.8		Simple Band-Aid
C4	212.8	212.6		Square Reservoir and Recess
C5	212.6	212.4		Square Reservoir and Flush
T4	212.4	212.2	Transition from Maxwell 71 to Crafco 522	Shallow Reservoir and Flush
D1	212.2	212.0	Crafco 522	Square Reservoir and Flush
D2	212.0	211.8		Square Reservoir and Recess
D3	211.8	211.6		Square Reservoir and Band-Aid
D4	211.6	211.4		Simple Band-Aid
D5	211.4	211.2		Shallow Reservoir and Flush
T5	211.2	211.0	Transition from Crafco 522 to Maxwell 72	Shallow Reservoir and Flush
E1	211.0	210.8	Maxwell Elastoflex 71	Square Reservoir and Recess
E2	210.8	210.6		Square Reservoir and Flush
E3	210.6	210.4		Simple Band-Aid
E4	210.4	210.2		Shallow Reservoir and Flush
E5	210.2	210.0		Square Reservoir and Band-Aid
T6	210.0	209.8	Transition from Maxwell 72 to Control Section	Shallow Reservoir and Flush
F	209.8	209.6	Control Section	No Routing or Sealing

Notes:
- Square reservoir was 3/4" x 3/4".
- Shallow reservoir was 1-1/2" x 3/8" deep.
- Band-Aids were achieved with a U-shaped squeegee.
- Flush, for other experimental items, was achieved without a squeegee.
- The first 11 cracks in transition T3 were routed 5/8" x 5/8" and were filled with Crafco 522.
- Crack sealing was performed from 24 August 1998 through 28 August 1998.

2 EVALUATION METHODOLOGY

Evaluations have generally been consistent with procedures outlined by the Strategic Highway Research Program (SHRP) Experiment H-106 (SHRP, 1991). Following the direction of crack sealing, the last eight full-width transverse cracks in each test section are evaluated. In addition, the final 300 feet of longitudinal centerline cracks are evaluated. Due to the abundance of cracks at the Helena site, the number of transverse cracks to be evaluated in each test section was increased to twelve. This larger sample size helped with comparisons between test sections base on the high variability in failure rates that were observed between cracks at the Conrad and Dutton locations.

Modes of failure included material failures and others that were caused by a combination of factors. A failure is considered as such if it permitted water to intrude into the pavement structure. Material failures included adhesion and cohesion failures. Adhesion failures are defined as the loss of bond between sealant and the edge of a reservoir. Cohesion failures are defined as any fracture within the sealant away from the crack edge. Non-routed, sealed cracks that split were considered cohesion failures exclusively due to the difficulty in distinguishing between adhesion and cohesion failure modes. Failures that were caused by a combination of factors included pullouts and secondary cracking. Pullout was defined as the complete removal of sections of sealant from the pavement. Pullouts typically occurred when a reservoir was involved, in which case the pullout may have been material and/or construction related. Pullouts also occurred when a Band-Aid or Capped sealing technique was involved, in which case the pullout may have been caused by a snowplow. Secondary cracking was the formation of additional cracks parallel to a sealed crack. These cracks may have been caused by routing or stiff sealants that did not allow efficient stress relief.

During evaluations, failures were measured and recorded. Failures were later quantified for each crack as a percentage of total crack length. Qualitative ratings were assigned to these percentages according to the SHRP protocol as shown in Table 9 (SHRP, 1991).

Table 9: Qualitative Ratings for Failure Percentages

Rating	Failure Percentage
Excellent	0 - 10
Good	11 - 20
Fair	21 - 35
Poor	36 - 50
Very Poor	51 - 100

Superficial sealant distresses were also recorded during evaluations. These distresses may have lead to future performance problems, but were not considered failures at the time of the evaluation because they did not permit the intrusion of water into the pavement structure. Superficial distresses included: bubbling, extrusion, tracking, stone intrusion, weathering, and wear. Rather than measuring the lengths of these distresses precisely, distresses were assigned lengths in one of three categories: less than one-third the crack length, one-third to two-thirds the crack length, and greater than two-thirds the crack length. Low-severity superficial distresses were disregarded in determining the length of distress estimates; only moderate- and high-severity distresses were considered.

The Tarkio and Helena sites each included a control test section where cracks were left unsealed. The conditions of these cracks were also monitored and are summarized by the relative proportions of low-, medium-, and high-severity crack lengths. Definitions for these levels of severity were consistent with those developed by SHRP (SHRP, 1993).

Site visits also involved sealant material characterization and pavement movement measurements. Sealant material characterizations were accomplished using the "coin test" (SHRP, 1991). To perform a coin test, a quarter was pushed halfway into the crack sealant. A subjective note was made on whether it was "easy" or "hard" to insert the quarter. Hypothetically, this test was to provide a general indication of how the sealant stiffness changes over time. Downward pressure on the quarter was then released and movement was monitored for one minute. The percent of recovery, or the percent of half-quarter length that was expelled, was noted to the nearest 25 percent (i.e., 0, 25, 50, 75 and 100 percent). Coin tests were only performed when the temperature of the materials were greater than 50°F.

Pavement movement was monitored by measuring the distance between masonry nails that were installed at one crack in each test section. A single nail was placed on each side of the crack. Initially, the distance between nails was roughly 6 to 12 inches. In most cases, special nails that have dimples in the center of their head (PK nails) were used because measurements between dimples were considered more consistent. For nails that did not have dimples, measurements were made between the left edges of nail heads. Because finding the nails without dimples was more difficult, new nails were installed during the summer 2000 evaluations.

Semiannual evaluations were made with a Falling Weight Deflectometer (FWD) at the Helena test site to quantify potential structural benefit associated with crack sealing. It is not the contention of the authors that crack sealing improves the structural qualities of the pavement directly, but rather that crack sealing may offer an improvement in a pavement's future structural integrity, a secondary benefit of keeping water out of the structure.

FWD evaluations occurred in late April to early May, and late August to early September. This provided a "wet" and a "dry" evaluation each year. Tracking changes for the test sections' back-calculated moduli and overall response stiffness helped understand potential "structural" benefits of crack sealing. Analyses concentrated on changes in properties over time, rather than comparing properties between sections at any point in time.

An inventory of cracks was obtained by walking each site in the direction of traffic. Distances from the beginning of each test section to the location of each transverse crack were recorded. As new cracks formed, they were included in the inventory. Distances from the beginning of test sections to the beginning and end of longitudinal cracks were also measured. These inventories helped keep track of the cracks that were being monitored. They also provided crack density data to better understand pavement movements. A history of the evaluations that have been conducted at each of the sites, the results of which are included in this report, is shown in Table 10.

Table 10: History of Crack Inventory and Condition Surveys of the Four Test Sites

Location	Task	Date
Conrad	Cracks filled	10/1995 & 5/1996
	Condition survey	12/19/1996
	Condition survey	7/18/1997
	Crack inventory	7/28/1998
	Condition survey	5/25/1999
	Condition survey and inventory	6/13/2000
	Final Condition survey and inventory	4/7/2001
Dutton	Cracks filled	7/1996
	Condition survey	3/1997
	Condition survey	6/5/1998
	Crack inventory	7/28/1998
	Condition survey	5/25/1999
	Final Condition survey and inventory	6/12/2000
Tarkio	Cracks filled	7/8 through 7/9/1998
	Condition survey and inventory	8/1998
	Condition survey and inventory	3/4/1999
	Condition survey	8/25/1999
	Condition survey and inventory	9/8/2000
	Final condition survey	5/15/2001
	Final crack inventory	7/30/2001
Helena	Cracks filled	8/24 through 8/28/1998
	Condition survey and inventory	10/1998
	Condition survey	2/26/1999
	Condition survey	7/16/1999
	Condition survey and inventory	8/7/2000
	Condition survey and inventory	4/17/2001
	Condition survey and inventory	9/11/2001
	Condition survey and inventory	2/21/2002
	Condition survey and inventory	8/28/2002
	Condition survey and inventory	5/6/2003

3 RESULTS

Summary data is provided in this section of the report for each of the test sites. Several appendices at the end of the report provide detailed data from the various data collection efforts conducted. Appendix A provides detailed weather data for each test site. Appendices B, C, D and E provide a comprehensive inventory of the cracks for the Conrad, Dutton, Tarkio and Helena test sites, respectively. Coin test data is provided in Appendix F. Pavement movement measurements are given in Appendix G. Appendices H, I, J and K provide condition survey (distress) data for the Conrad, Dutton, Tarkio and Helena sites, respectively. Appendix L shows the structural condition data for the Helena site. Appendix M shows the detailed results of the forecasting analysis to predict the useful life of various sealant material/fill technique combinations at the Helena site.

3.1 Crack Inventory

As part of the evaluation of each of the four test sites, an inventory of crack propagation was recorded. Based on the initial cracks that were sealed, periodic site visits were conducted to investigate crack growth. As part of the analysis, the initial lengths of the cracks were summed, thereby establishing a total length of transverse and longitudinal cracks. Formation of additional transverse cracks and extension/formation of longitudinal cracks were recorded. For comparison, lengths of additional cracks were normalized by the combined lengths of the individual test sections. The combined lengths for Conrad, Tarkio and Helena are 29,712 feet, 21,128 feet and 27,581 feet, respectively. The total length of the Dutton site was not necessary since no crack formation/propagation occurred during its evaluation period.

Comparisons between the test sites showed that the highest cumulative, normalized percentage of transverse crack formation (3 percent) was at the Helena site (Figure 3). Neither Tarkio nor Dutton experienced transverse crack formation during their respective evaluation periods.

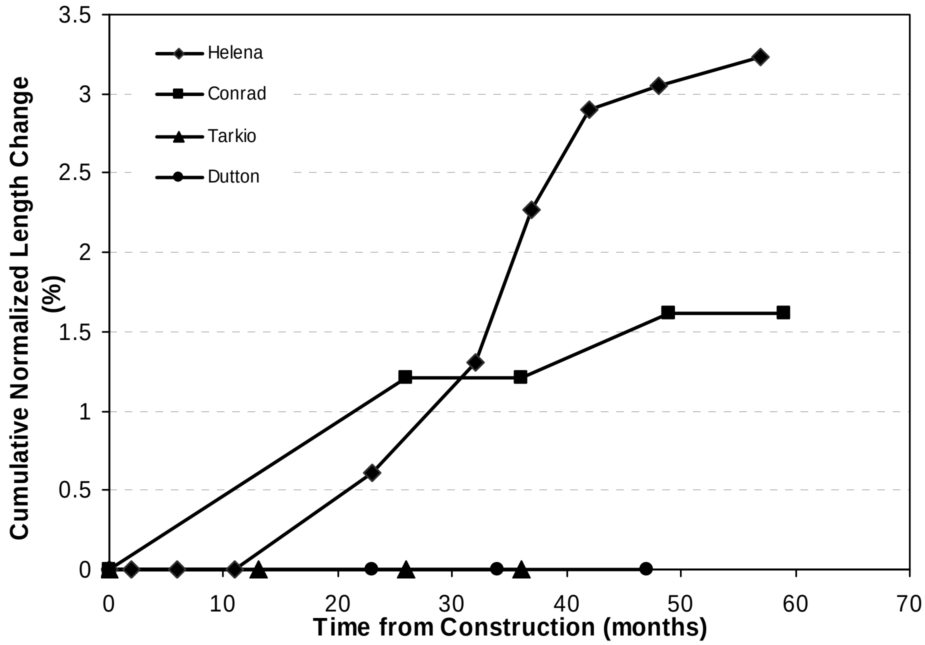

Figure 3: Comparison of Transverse Crack Propagation

Longitudinal crack formation/propagation was greatest at the Conrad test site. Longitudinal crack development did not occur at the Dutton or Helena sites. Longitudinal crack development occurred at the Tarkio site only between the last two site investigations. Figure 4 shows longitudinal crack development for all the test sites.

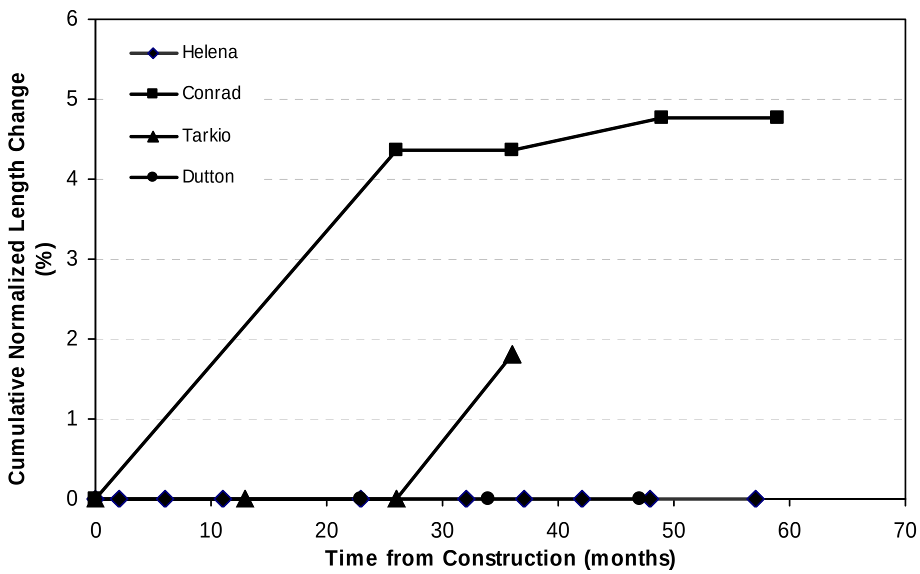

Figure 4: Comparison of Longitudinal Crack Propagation

3.2 Coin Test Results

The coin test, which originated with the research that SHRP conducted, was developed to attempt to correlate between field and laboratory tests and field performance. This test was intended to provide a simple evaluation of the resiliency of the sealant material. By monitoring how quickly a quarter is ejected after being depressed into the sealant material approximately 0.5 inches, a subjective measure of the material's resiliency can be made (SHRP, 1991).

During most material tests, the quarter was easily pushed into the sealant. The two exceptions were Crafco 221 at the Conrad site and Crafco 516 at the Dutton site, where sealant materials were hard to deform. This finding provided evidence that the Crafco construction crew had placed the Crafco 516 material in the wrong section during installation, as discussed earlier. In addition to stiffness data, resiliency data from the coin tests are also included. During the first year of performing coin tests, only one test was performed for each material. Subsequent inspections have involved two coin tests per material. Comprehensive coin test data are shown in Appendix F.

Overall, the coin test results collected as part of this study were inconclusive for a number of reasons. First, the coin test was not designed to provide accurate measurements of resiliency but rather a subjective measure. Correlating the results from the coin test to the performance of crack sealant material is therefore impossible. For example, coin tests performed at the Helena site indicated that, in general, it was hard to push the quarter into the sealant and that only half to three-quarters of the quarter was rejected within 60 seconds. This, however, does not correlate well with the performance of the sealant materials at the Helena site based on the measured distresses. Second, since only a subjective measure is made regarding the amount the coin is rejected, test results are considered vague. Lastly, the temperature of the material during the time it was tested greatly affected its resiliency, making it difficult to separate true resiliency from weather induced material changes.

3.3 Pavement Movement

Pavement movement measurements are shown in Appendix G. Measurements taken prior to 1998 have been excluded because many of the masonry nails were installed in 1998 and many of the previous years' measurements were not accompanied by pavement surface temperature data. The extremes through which the pavement moves can only be determined from measurements obtained during cold temperatures. Although many attempts to gather this information were made, unfortunately, they were never taken. Without knowing the absolute difference in crack width from cold to hot temperatures, it was difficult to make conclusive remarks regarding the relationship between crack movement and material distresses.

3.4 Condition Survey Results

Condition survey results are included in Appendices H through K. For each appendix, the condition survey results are presented separately for each test section. Data are also presented separately for longitudinal and transverse cracks. For transverse cracks, the data on failure percentages include a coefficient of variation (C.V.) for each type of distress. These coefficients of variation provide an indication of the variability in performance between cracks within the same test section. Higher coefficients of variation indicate a greater variation between crack distresses within that section.

Abbreviations were used to present distress data in a concise manner. These abbreviations (Table 11) have been used throughout the following discussion and the summary tables presented in this section, as well as the appendices.

Table 11: Summary of Abbreviations for Test Site Descriptions and Distress Information

Crack Sealing Techniques	
BA	Simple Band-Aid
CAP	Capped
SQ-F	Square Reservoir and Flush
SQ-R	Square Reservoir and Recess
SQ-BA	Square Reservoir and Band-Aid
SH-F	Shallow Reservoir and Flush
Failures	
AF	Adhesion Failure
CF	Cohesion Failure
PO	Pullout
SC	Secondary Cracking
Superficial Distresses	
B	Bubbling
E	Extrusion
SI	Stone Intrusion
T	Tracking
W	Weathering
WR	Wear
Extent of Superficial Distress[a]	
(1)	Less Than One-Third
(2)	One-Third to Two-Thirds
(3)	Greater Than Two-Thirds
[a] as a fraction of the length of sealed cracks, considering only moderate- and high-severity distresses	

Condition survey results are summarized in Tables 12 through 19. Distresses in transverse and longitudinal cracks at the Conrad site are presented in Tables 12 and 13, respectively. Distresses in the transverse cracks at the Dutton site are presented in Table 14. Distresses in the transverse and longitudinal cracks at the Tarkio site are presented in Table 15 and 16, respectively. Tables 17, 18, 19 and 20 summarize the distresses in the transverse cracks at the Helena site at six, thirty-two, forty-two and fifty-seven months following construction, respectively. The distress summaries for the Conrad, Dutton and Tarkio sites represent their final conditions approximately five, four and three years after construction, respectively.

3.4.1 Conrad Condition Survey Results

The distress summary for transverse cracks at the Conrad site (Table 12) revealed that the Band-Aid, Capped, and Square Reservoir and Recessed configurations experienced the most failures. In fact, all test sections with the Band-Aid or Capped sealing configuration had experienced 100 percent cohesion failure. Two of the test sections with the Square Reservoir and Recess configuration (Crafco 231 and Maxwell 60) had experienced 100 percent cohesion failure while Crafco 221 had experienced both adhesion failure and secondary cracking. On average, Crafco 221 and Crafco 231 performed better than Maxwell 60. The average failure of Crafco 221 and 231 were 73.2 and 60.2 percent, respectively, while Maxwell 60 had an average failure of 77.5 percent. The Crafco 221 site did not include a Shallow and Flush technique, which would have potentially decreased the average failure for this product since it usually performs well. Nevertheless, among these three materials, Crafco 221 was relatively stiff, having the lowest cone penetration (ASTM D 5329). The section with Crafco 221 also had some high percentages of secondary cracking. This could be caused by dull routing blades or by the fact that Crafco 221 does not offer quick relief from stress during crack movements. Perhaps for this reason, the bond test (ASTM D 5329) for Crafco 221 was performed to 50 percent extension, rather than to the standard 200 percent extension.

During the final inspection of the Conrad test site, a detailed examination of the longitudinal cracking was made. Relative to previous inspections, increased rates of failure were noted. Most notable were dramatic increases in the rate of cohesion failure for Simple Band-Aid and Capped configurations. Neither of these techniques incorporates a routing step and simply seals the crack with minimal preparation. In locations where excellent performance had been previously noted for these techniques in conjunction with the various sealant materials, poor performance was now exhibited. In fact, 100 percent failure rates were seen for both techniques with either Maxwell 60 or Crafco 231 sealants. In general, as the age of sealant materials increases, their resiliency decreases, thereby making them less flexible and more prone to cohesion and adhesion failures. Increases in secondary cracking were also seen in many of the routed sections. Overall, Crafco 221 outperformed both Crafco 231 and Maxwell 60 materials when used as longitudinal sealant as shown by their average material failures: 23.5, 61.8, and 54.8 percent, respectively. Table 13 shows the failure rates for the longitudinal cracking at the Conrad site.

Table 12: Final Summary of Average Distress for Transverse Cracks at the Conrad Site Five Years after Construction

Material	Technique	Material Failures AF (%)	Material Failures CF (%)	Material Failures Total (%)	PO (%)	SC (%)	Total Failure (%)	Superficial Distress
Crafco 221	SQ-F	9.1	1.2	10.2	0.0	32.6	42.7	W(2)
	SQ-BA	40.3	0.0	40.3	0.0	14.6	54.9	W(2), WR(2)
	BA	0.0	100.0	0.0	0.0	0.0	100.0	WR(1)
	SQ-R	29.8	0.0	29.0	2.3	38.0	68.6	W(2)
	CAP	0.0	100.0	0.0	0.0	0.0	100.0	None
Maxwell 60	SQ-F	36.5	0.0	36.3	0.0	6.7	43.0	W(2)
	SQ-BA	73.6	0.0	72.4	0.0	12.3	84.7	SI(2), W(2), WR(2)
	BA	0.0	100.0	0.0	0.0	0.0	100.0	W(2)
	SQ-R	0.0	100.0	0.0	0.0	0.0	100.0	SI(1), W(3)
	CAP	0.0	100.0	0.0	0.0	0.0	100.0	W(1)
	SH-F	27.7	0.0	27.7	0.0	9.7	37.3	B(1), SI(2), W(2)
Crafco 231	SQ-F	9.5	0.0	9.5	0.0	8.6	17.9	SI(3), W(2)
	SQ-BA	8.9	0.0	8.8	0.0	13.2	22.0	SI(3), W(2), WR(1)
	BA	0.0	100.0	0.0	0.0	0.0	100.0	W(1),WR(2)
	SQ-R	0.0	100.0	0.0	0.0	0.0	100.0	SI(3), W(3)
	CAP	0.0	100.0	0.0	0.0	0.0	100.0	WR(2)
	SH-F	5.5	4.2	9.6	0.0	11.6	21.2	SI(3), W(2), WR(1)

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

Note: Each material/technique combination includes evaluations for eight full-width cracks, with exception for the following.

- Crafco 221 with SQ-R: five of the eight cracks were evaluated only in the traveling lane (passing lane was cracked, but not routed).
- Maxwell 60 with SQ-R: all eight cracks were evaluated only in the passing lane (traveling lane was routed and sealed with a Band-Aid).
- Maxwell 60 with SH-F: only seven cracks were available for the evaluation.

Contrasting this startling increase in failure was the consistent performance from the three routed methods of sealing. Poor performance was still being displayed by the Square and Recessed technique with all of the sealants. However, good to excellent behavior was generally found in the Square and Flush, Square and Band-Aid, and the Shallow and Flush sections. It now appears that the routing of longitudinal cracks has a positive effect on their long-term performance with all but the Square and Recessed method.

Table 13: Final Summary of Average Distress for Longitudinal Centerline Cracks at the Conrad Site Five Years after Construction

Material	Technique	Material Failures AF (%)	Material Failures CF (%)	Material Failures Total (%)	PO (%)	SC (%)	Total Failure (%)	Superficial Distress
Crafco 221	SQ-F	0.0	0.0	0.0	0.0	0.0	0.0	W(1)
	SQ-BA	0.3	0.0	0.3	0.0	24.0	24.3	W(1),WR(1)
	BA	0.0	33.7	33.7	0.0	0.0	33.7	None
	SQ-R	0.0	0.0	0.0	0.0	23.4	23.4	W(1)
	CAP	0.0	0.0	0.0	24.3	11.7	36.0	None
Maxwell 60	SQ-F	0.0	0.0	0.0	0.1	60.0	60.1	W(1)
	SQ-BA	0.0	0.0	0.0	0.0	3.7	3.7	SI(1),W(1)
	BA	0.0	100.0	100.0	0.0	0.0	100.0	W(1)
	SQ-R	0.0	100.0	0.0	0.0	0.0	100.0	W(1)
	CAP	0.0	100.0	100.0	0.0	0.0	100.0	None
	SH-F	0.0	0.0	0.0	0.0	6.8	6.8	W(1)
Crafco 231	SQ-F	11.7	0.0	11.7	0.0	11.7	23.3	SI(1),W(1)
	SQ-BA	0.0	4.7	4.7	0.0	0.0	4.7	W(1)
	BA	0.0	100.0	100.0	0.0	0.0	100.0	None
	SQ-R	0.0	100.0	0.0	0.0	0.0	100.0	SI(2),W(2)
	CAP	0.0	100.0	100.0	0.0	0.0	100.0	None
	SH-F	0.0	0.0	0.0	0.0	0.5	0.5	SI(3),W(1)

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

Note: Each material/technique combination includes evaluations for a total crack length of 300 ft, with exception for the following:

- Maxwell 60 with SH-F: only 231 ft of longitudinal centerline cracks were available for the evaluation.

3.4.2 Dutton Condition Survey Results

Review of the distress summary for transverse cracks at the Dutton site (Table 14) revealed that Crafco 516 performed noticeably worse than Crafco 299, Crafco 522, or Crafco 231. Crafco 516 was a stiffer material than the others, offering a cone penetration (ASTM D 5329) of only 50 to 80. The difference in performance between the latter three Crafco products continues to be small. Crafco 516 suffered primarily cohesion failures with the shallow reservoir, and it suffered primarily secondary cracking failures with the square reservoir. For the remaining materials, there did not appear to be a significant difference between the shallow and square reservoir fill techniques with respect to secondary cracking. There were no longitudinal cracks at the Dutton test site.

Table 14: Final Summary of Average Distress for Transverse Cracks at the Dutton Site Four Years after Construction

Material	Technique	Material Failures AF (%)	Material Failures CF (%)	Material Failures Total (%)	PO (%)	SC (%)	Total Failure (%)	Superficial Distress
Crafco 231	SH-F	0.0	0.0	0.0	0.0	13.9	13.9	SI(2), W(2)
	SQ-F	3.1	0.0	1.0	0.0	8.0	9.0	B(1), SI(2), W(2)
Crafco 299	SH-F	1.4	5.0	5.7	0.0	8.3	14.1	B(1), SI(2), W(2)
	SQ-F	0.0	0.0	0.0	0.0	8.9	8.9	SI(2), W(2)
Crafco 516	SH-F	9.0	22.3	31.3	0.0	18.8	50.1	B(1), SI(2), W(2)
	SQ-F	0.0	9.2	9.2	0.0	59.0	68.2	SI(2), W(2)
Crafco 522	SH-F	0.0	0.0	0.0	0.0	11.9	11.9	SI(2), W(2)
	SQ-F	2.6	0.0	2.0	0.0	14.1	16.1	B(1), SI(2), W(2)

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

Note: Each material/technique combination includes evaluations for eight full-width cracks, with exception for the following.

- Crafco 229 with SH-F: all eight cracks were evaluated only in the passing lane (traveling lane was routed and sealed prior to test section construction).
- Crafco 516 with SH-F: all eight cracks were evaluated only in the passing lane (traveling lane was routed and sealed prior to test section construction).
- Crafco 516 with SQ-F: only four cracks were available for the evaluation.
- Crafco 231 with SQ-F: only one crack was available for the evaluation.

3.4.3 Tarkio Condition Survey Results

Inspection of the summary for transverse and longitudinal cracks at the Tarkio site (Tables 15 and 16, respectively) revealed that after three years, most material/technique combinations were performing quite well. The material/technique combination that experienced the greatest failure was, again, the Square Reservoir and Recessed. This method consistently had more than three times the amount of total failure when compared to other methods, with the exception of the Band-Aid technique coupled with Crafco 221. Again, the test sections performed well, but the limited number of cracks across the site minimized the ability to draw definitive conclusions.

Table 15: Final Summary of Average Distress for Transverse Cracks at the Tarkio Site Three Years after Construction

Material	Technique	Material Failures			PO (%)	SC (%)	Total Failure (%)	Superficial Distress
		AF (%)	CF (%)	Total (%)				
Crafco 231	SH-F	0.2	0.0	0.2	0.0	3.5	3.6	None
	SQ-R	3.5	0.0	3.5	0.0	45.5	49.0	None
	BA	0.0	10.9	10.9	0.0	2.8	13.7	None
	SQ-BA	0.0	0.0	0.0	0.0	0.0	0.0	None
	SQ-F	1.4	0.0	1.4	0.0	5.8	7.2	None
Crafco 522	SH-F	0.0	0.0	0.0	0.0	0.3	0.3	None
	SQ-R	3.7	0.0	3.7	0.0	15.6	19.3	None
	BA	0.1	3.2	3.3	1.1	0.8	5.1	None
	SQ-BA	0.3	0.0	0.3	0.0	0.3	0.5	None
	SQ-F	0.0	0.0	0.0	0.0	0.4	0.4	None
Maxwell 72	SH-F	0.5	0.0	0.5	0.0	1.0	1.5	None
	SQ-R	10.1	0.0	10.1	0.0	33.0	43.1	None
Crafco 221	SQ-R	27.1	0.0	27.1	0.0	16.0	43.1	None
	BA	0.0	36.3	36.3	0.7	5.4	42.4	None
	SQ-BA	0.0	0.5	0.5	0.0	0.0	0.5	None

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

Table 16: Final Summary of Average Distress for Longitudinal Cracks at the Tarkio Site Three Years after Construction

Material	Technique	Material Failures			PO (%)	SC (%)	Total Failure (%)	Superficial Distress
		AF (%)	CF (%)	Total (%)				
Crafco 231	SH-F	4.2	0.0	4.2	0.0	27.4	31.6	None
	SQ-R	1.4	0.0	1.4	0.0	8.0	9.4	None
	BA	0.0	0.1	0.1	0.0	1.0	1.2	None
	SQ-BA	0.0	0.0	0.0	0.0	1.9	1.9	None
	SQ-F	0.0	0.0	0.0	0.0	11.3	11.3	None
Crafco 522	SH-F	0.9	0.0	0.9	0.0	2.0	2.9	None
	SQ-R	25.0	0.0	17.0	0.0	22.0	37.0	None
	BA	0.0	0.1	0.1	0.0	0.0	0.1	None
	SQ-BA	6.2	0.0	6.6	0.0	0.4	6.6	None
	SQ-F	2.6	0.0	2.6	0.0	1.9	4.4	None
Maxwell 72	SH-F	0.5	0.0	0.5	0.0	3.8	4.4	None
	SQ-R	0.1	0.0	0.1	0.0	25.7	25.8	None

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

The Tarkio site also included a control section, where the cracks were left unsealed. This test section is not included in Table 15 because the inspection procedures were different than for the sealed cracks. Unsealed transverse cracks (in the control section) showed an average condition of 92% low-severity, 5% medium-severity, and 3% high-severity. The unsealed longitudinal cracks had a cumulative condition of 100% low-severity. These cracks generally remained in good condition after a year of service.

3.4.4 Helena Condition Survey Results

Evaluations of the Helena test site occurred at two, six (Table 17), eleven, twenty-three, thirty-two (Table 18), thirty-six, forty-two (Table 19), forty-eight and fifty-seven months (Table 20) following construction. The two-month evaluation was primarily to determine the extent of failure related to construction. Consistent with the high quality construction practices observed here, only minor construction related failures were revealed during this evaluation. The only distresses encountered were minimal amounts of secondary cracking.

Subsequent data collection at the Helena site revealed cyclic failure trends based on seasonal variations. Evaluations that followed extended periods of cold temperatures showed a higher percentage of total failure when compared to evaluations following extended periods of high temperatures. Evaluations that followed the winter were conducted at six, thirty-two and forty-two and fifty-seven months following construction. A summary of failure percentages for these evaluations is shown in Tables 17, 18, 19 and 20. Table 20 shows the most recently collected (and final) data which was collected at fifty-seven months past construction.

Table 17: Summary of Average Distress for Transverse Cracks at the Helena Site as of February 1999 – Six Months after Construction

Material	Technique	Material Failures			PO (%)	SC (%)	Total Failure (%)	Superficial Distress
		AF (%)	CF (%)	Total (%)				
Crafco 231	SH-F	0.0	0.0	0.0	0.0	6.6	6.6	None
	SQ-R	0.0	0.0	0.0	0.0	16.5	16.5	None
	BA	0.0	1.6	1.6	0.0	2.0	3.6	None
	SQ-BA	0.1	0.0	0.1	0.0	3.0	3.0	None
	SQ-F	0.0	0.0	0.0	0.0	10.8	10.8	None
Crafco 522	SH-F	0.0	0.0	0.0	0.0	5.9	5.9	None
	SQ-R	0.0	0.0	0.0	0.0	16.4	16.4	None
	BA	0.0	1.1	1.1	0.0	3.4	4.5	None
	SQ-BA	0.0	0.0	0.0	0.0	4.3	4.3	None
	SQ-F	0.0	0.0	0.0	0.0	9.2	9.2	None
Maxwell 71	SH-F	0.0	0.0	0.0	0.0	4.6	4.6	None
	SQ-R	4.0	0.0	4.0	0.0	12.2	16.2	None
	BA	0.0	25.7	25.7	0.0	7.0	32.7	None
	SQ-BA	0.0	0.0	0.0	0.0	6.0	6.0	None
	SQ-F	0.1	0.0	0.1	0.0	10.7	10.7	None
Maxwell 72	SH-F	0.0	0.0	0.0	0.0	4.4	4.4	None
	SQ-R	5.2	0.0	5.2	0.0	15.3	20.4	None
	BA	0.0	46.0	46.0	0.0	3.4	49.4	None
	SQ-BA	0.1	0.0	0.1	0.0	14.4	14.5	None
	SQ-F	0.0	0.0	0.0	0.0	7.3	7.3	None
Deery 101 ELT	SH-F	0.0	0.0	0.0	0.0	2.5	2.5	None
	SQ-R	3.4	0.0	3.4	0.0	18.7	22.1	None
	BA	0.0	56.1	56.1	0.0	0.0	56.1	None
	SQ-BA	0.3	0.0	0.3	0.0	4.0	4.3	None
	SQ-F	0.1	0.0	0.1	0.0	4.9	4.9	None
Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF) Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)								

At six months, the greatest amount of failure was cohesion failure in the Band-Aid technique. Overall, the Crafco products had experienced the least amount of failure. The highest amounts of secondary cracking occurred in cracks that utilized a square reservoir, with Square Reservoir and Recessed showing the greatest percentage of secondary cracking overall.

Table 18: Summary of Average Distress for Transverse Cracks at the Helena Site as of April 2001 – Thirty-Two Months after Construction

Material	Technique	Material Failures			PO (%)	SC (%)	Total Failure (%)	Superficial Distress
		AF (%)	CF (%)	Total (%)				
Crafco 231	SH-F	1.4	0.0	1.4	0.0	8.2	9.5	None
	SQ-R	0.5	0.0	0.5	0.0	21.2	21.7	None
	BA	0.0	33.9	33.9	0.8	3.2	37.9	None
	SQ-BA	1.1	0.1	1.2	0.0	4.3	5.5	None
	SQ-F	0.4	0.0	0.4	0.0	12.6	13.0	None
Crafco 522	SH-F	0.2	0.0	0.1	0.0	5.8	6.0	None
	SQ-R	2.5	0.0	2.4	0.0	21.6	24.0	None
	BA	0.0	14.6	14.6	0.0	4.3	19.0	None
	SQ-BA	0.6	0.0	0.6	0.0	5.9	6.5	None
	SQ-F	0.1	0.0	0.1	0.0	10.0	10.2	None
Maxwell 71	SH-F	0.4	0.0	0.4	0.0	6.5	6.9	None
	SQ-R	42.9	0.0	39.0	0.0	22.8	61.8	None
	BA	0.0	93.2	93.2	0.6	6.0	99.8	None
	SQ-BA	0.1	0.0	0.1	0.0	11.5	11.6	None
	SQ-F	2.0	0.0	1.9	0.0	14.1	16.0	None
Maxwell 72	SH-F	0.8	0.0	0.8	0.0	5.7	6.5	None
	SQ-R	27.2	0.0	24.8	0.0	25.8	50.6	None
	BA	0.0	90.5	90.5	0.0	4.8	95.3	None
	SQ-BA	101.4	0.1	55.5	0.0	29.2	84.7	None
	SQ-F	2.3	0.0	2.1	0.0	10.6	12.7	None
Deery 101 ELT	SH-F	4.2	42.7	46.2	0.0	3.4	49.7	None
	SQ-R	96.0	0.1	52.0	0.0	23.6	75.6	None
	BA	0.0	93.2	93.2	3.9	2.1	99.1	None
	SQ-BA	73.4	0.0	35.7	0.0	24.3	60.0	None
	SQ-F	130.2	5.8	66.5	0.0	11.1	77.6	None

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

At thirty-two months, the Band-Aid technique was still showing large amounts of cohesion failure. In general, cracks utilizing a square reservoir were experiencing the greatest amount of secondary cracking. In terms of sealant material, the Deery 101 material was performing the worst overall, having an average of 82.4 percent failure independent of technique.

After approximately two years of service, adhesion failure was seen on both walls of a crack in a single reach (Figure 5) at the Helena site. In some cases, if more than half of the length of a crack was experiencing dual adhesion failure, the percent failure will be greater than 100. When calculating the total material failures the overlap will be accounted for, resulting in a value less than or equal to 100 percent. Dual adhesion failure of this type was seen in significant quantities in both of the Maxwell products as well as the Deery material. It is believed that failure of this type is likely to be the result of poor low-temperature resiliency. The combination of colder temperatures and pavement contraction causes internal stresses in the sealant to increase. If the sealant material does not have sufficient resiliency to resist these stresses, failure will ensue. In the past, stress relief had been provided through either cohesion or adhesions failures. Techniques that seem to be most prone to this behavior were the Square Reservoir and Flush, Square Reservoir and Band-Aid, and the Shallow Reservoir and Flush methods.

Figure 5: Example of Double Adhesion Failure Associated with the Shallow and Flush Technique

Table 19: Summary of Average Distress for Transverse Cracks at the Helena Site as of February 2002 – Forty-Two Months following Construction

Material	Technique	Material Failures AF (%)	Material Failures CF (%)	Material Failures Total (%)	PO (%)	SC (%)	Total Failure (%)	Superficial Distress
Crafco 231*	SH-F	2.0	0.0	2.0	0.0	9.2	11.2	None
	SQ-R	3.4	0.0	2.3	0.0	26.7	29.1	None
	BA	0.0	64.8	64.8	1.1	3.8	69.6	WR(2)
	SQ-BA	0.8	0.5	1.3	0.0	7.4	8.7	WR(2)
	SQ-F	0.5	0.0	0.4	0.0	10.2	10.6	None
Crafco 522	SH-F	0.0	0.0	0.0	0.0	8.3	8.3	None
	SQ-R	2.1	0.0	1.3	0.0	24.0	25.3	None
	BA	0.0	21.4	21.4	0.0	4.8	26.2	None
	SQ-BA	0.0	0.1	0.1	0.0	6.6	6.7	None
	SQ-F	0.2	0.0	0.1	0.0	11.4	11.5	None
Maxwell 71	SH-F	0.2	0.0	0.2	0.0	6.3	6.5	None
	SQ-R	43.4	0.0	41.0	0.0	14.9	55.9	None
	BA	0.0	99.4	99.4	0.4	6.9	99.4	None
	SQ-BA	55.6	0.0	30.1	0.0	8.7	38.8	None
	SQ-F	9.9	0.0	6.0	0.0	13.5	19.4	None
Maxwell 72*	SH-F	0.1	0.0	0.1	0.0	7.1	7.2	None
	SQ-R	14.7	0.0	14.7	0.0	36.0	50.7	None
	BA	0.0	98.4	98.4	0.0	3.1	99.0	WR(2)
	SQ-BA	2.3	0.1	2.3	0.0	16.9	19.3	None
	SQ-F	10.0	0.0	6.0	0.0	13.0	19.0	None
Deery 101 ELT	SH-F	120.7	7.5	70.7	0.0	7.4	78.0	None
	SQ-R	43.3	0.3	34.1	0.0	32.3	66.4	None
	BA	0.0	97.0	97.0	4.6	1.3	98.0	B(1),WR(2)
	SQ-BA	101.0	0.0	53.9	0.0	7.6	61.4	None
	SQ-F	128.2	0.3	64.6	0.0	7.2	71.7	None

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)
* Data was collected three months later (45 months past construction) due to bad weather

At 42 months, Crafco materials are performing better than the Maxwell and Deery products. Crafco 522 has performed the best overall.

Table 20: Summary of Average Distress for Transverse Cracks at the Helena Site as of May 2003 – Fifty-Seven Months following Construction

Material	Technique	Material Failures AF (%)	Material Failures CF (%)	Material Failures Total (%)	PO (%)	SC (%)	Total Failure (%)	Superficial Distress
Crafco 231	SH-F	0.1	0.0	0.1	0.0	8.0	8.2	None
	SQ-R	0.7	0.0	0.7	0.0	11.5	12.1	None
	BA	0.0	43.6	43.6	1.8	3.1	48.5	WR(3)
	SQ-BA	0.2	0.1	0.4	0.0	4.0	4.3	WR(3)
	SQ-F	5.1	0.0	5.1	0.0	23.4	27.5	None
Crafco 522	SH-F	0.0	0.0	0.0	0.0	8.4	8.3	None
	SQ-R	1.1	0.0	1.1	0.0	29.2	30.3	None
	BA	0.0	41.3	41.3	0.0	6.0	47.3	WR(2)
	SQ-BA	0.2	0.1	0.2	0.0	6.7	6.9	WR(2)
	SQ-F	0.3	0.0	0.3	0.0	11.1	11.5	None
Maxwell 71	SH-F	0.0	14.1	14.1	0.0	5.0	19.2	None
	SQ-R	27.3	0.0	27.3	0.0	17.6	44.9	None
	BA	0.0	100.0	100.0	0.0	6.6	100.0	WR(3)
	SQ-BA	80.2	0.0	40.1	0.0	10.6	50.7	WR(3)
	SQ-F	30.5	3.4	22.5	0.0	11.4	33.9	None
Maxwell 72	SH-F	0.1	0.0	0.1	0.0	4.9	4.9	None
	SQ-R	29.1	0.0	27.9	0.0	17.8	45.7	None
	BA	0.0	97.7	97.7	0.0	2.3	97.9	WR(3)
	SQ-BA	0.8	0.0	0.6	0.0	11.7	12.3	WR(3)
	SQ-F	1.2	0.0	1.2	0.0	9.1	10.4	None
Deery 101 ELT	SH-F	63.6	20.0	54.6	0.0	4.7	59.3	None
	SQ-R	38.1	0.3	36.7	0.0	21.4	58.0	None
	BA	0.0	59.0	59.0	0.8	0.2	59.8	WR(2)
	SQ-BA	95.9	0.1	51.4	0.0	5.3	56.1	None
	SQ-F	123.8	0.0	63.8	0.0	4.5	64.7	None

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) - overlap (AF/AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) - overlap (MF/PO/SC)

At fifty-seven months past construction, most of the cracks at the Helena site are performing quite well. Most of the material-technique combinations were experiencing less than 50% total failure even after this final winter season. In general, the Band-Aid technique had high failures regardless of material and the Deery 101 material had the highest rate of failure.

In general, the greatest failure levels in the cracks correspond with the wettest times of the year thereby allowing a good percentage of the annual precipitation to infiltrate into the pavement structure. Therefore, even though there is a healing effect during the summer months, it doesn't improve the crack's ability to restrict water infiltration since it happens during the driest time of the year. Overall, however, the healing effect most likely provides benefit since it helps prolong moisture blockage into the fall and early winter. These conclusions are based on generalizations derived from comprehensive look at the Helena data and are therefore subject to further scrutiny. The healing effect may either be re-bonding between materials, or the thermal closing of the crack.

A comparison between the various materials and techniques was made that considered only total failures after the winter season. To do this, the total failures for a particular material were averaged irrespective of the technique used when filling the crack. Similarly, the total failures for a particular technique were averaged irrespective of the material used to fill the crack. Figures 6 and 7 show the average total failure for the materials only and techniques only, respectively. Results show that the Crafco 522 material and the Shallow and Flush technique performed the best overall, while the Deery 101 material and the Band-Aid technique performed worst.

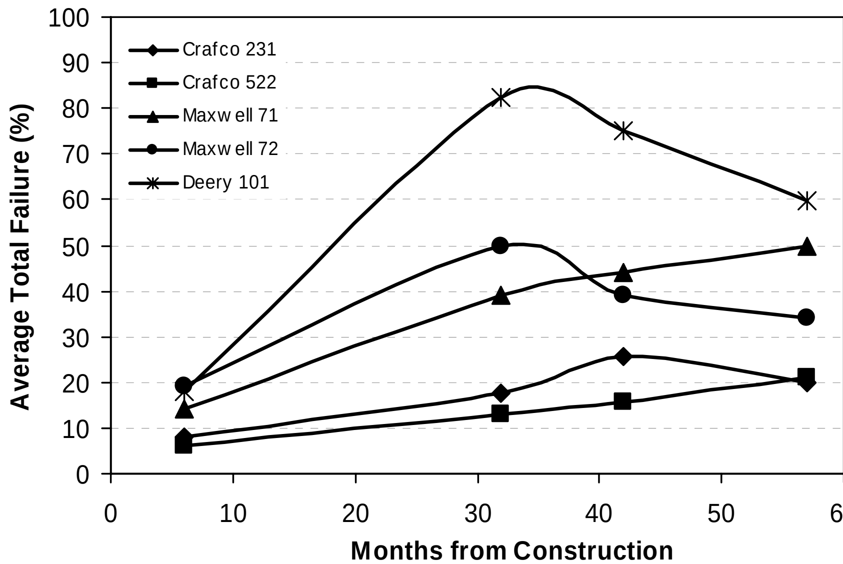

Figure 6: Average Total Failure of Sealant Materials Independent of Fill Technique for Helena

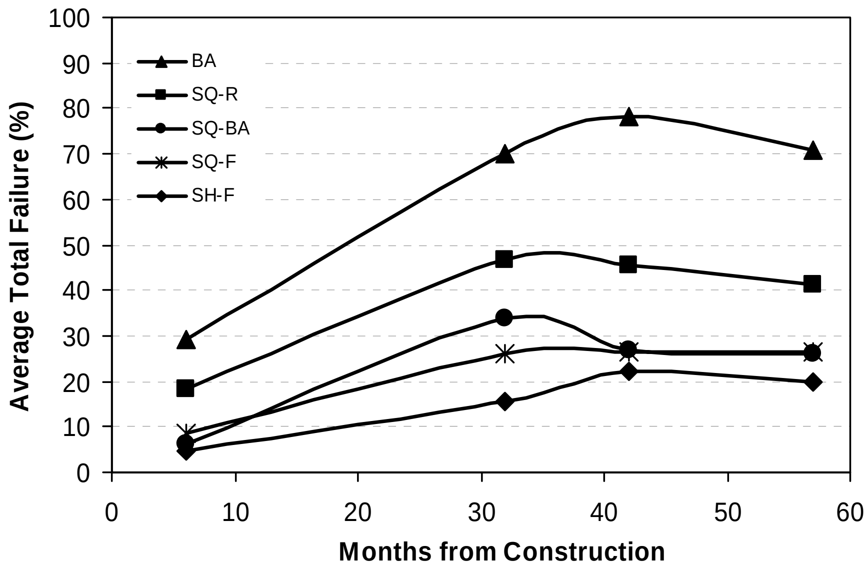

Figure 7: Average Total Failure of Fill Technique Independent of Sealant Materials for Helena

Most of the cracks at the Helena site have not yet reached 50% failure; so useful life cannot be estimated without the help of statistical forecasting. Despite seasonal fluctuations, variations of failure during winter or summer exhibited linearity common to younger cracks, as in Dutton and Tarkio. Based on these observations, predicting the useful life of individual materials, techniques, or combinations thereof is reasonable depending on the quality of the data. Utilizing a successful forecasting method has helped estimate the effective life of crack sealing, which will ultimately be used in the life cycle cost analysis.

An eclectic forecasting model was developed to incorporate both the exponential trend observed at Conrad and the seasonality trend observed in Helena. The Winter's forecasting model was used to predict seasonally varying distresses in crack sealing, however, this model assumed that seasonal fluctuations increased linearly over time. Therefore, an exponential model was integrated with the Winter's model to increase the accuracy of predicted failures.

The average total failure from the summer (determined from evaluations conducted at 2, 11, 23, 37, 48 months from construction) and winter (determined from evaluations conducted at 6, 18, 32, 42, 57 months from construction) seasons were used as the inputs into the Winter's forecasting model. This forecasting model used three smoothing constants to reduce analytical errors: alpha (level), gamma (trend) and delta (seasonal). These three variables, which have a value between 0 and 1, were optimized to minimize Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Squared Deviation (MSD). An example of the results of the Winter's analysis for the Crafco 522 material combined with the Band-Aid technique is shown in Figure 8.

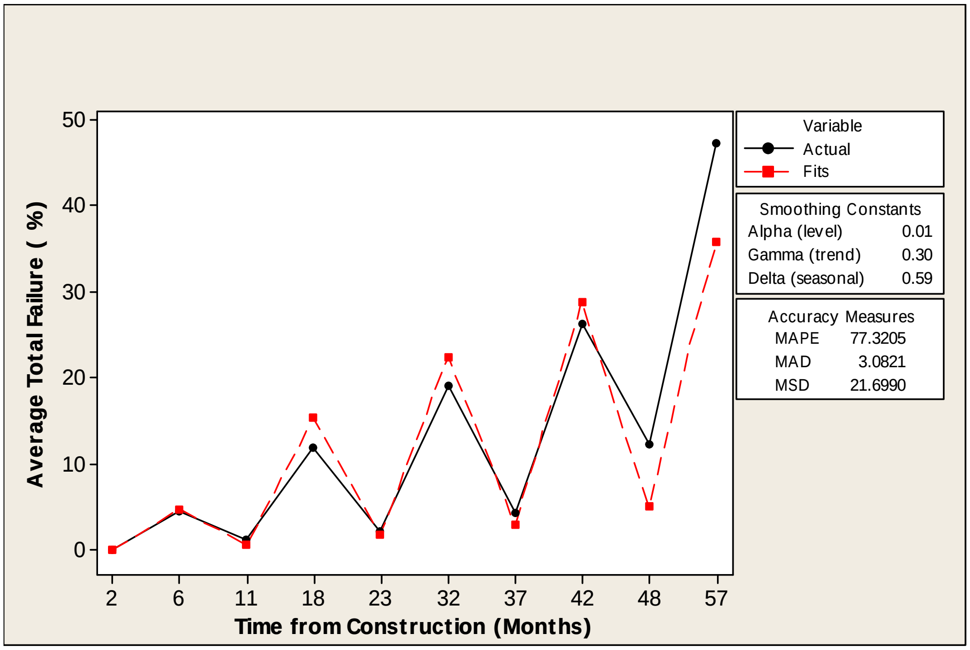

Figure 8: Winter's Seasonal Exponential Smoothing for Crafco 522, BA

Exponential forecasting was performed using only the total failures from the winter seasons (determined from evaluations conducted at 6, 18, 32, and 42 months). The values from the 57th month evaluation were lower than expected for the winter season; which may have been due to milder weather, more sunny days, etc.; and were therefore omitted from the exponential forecasting since they skewed the results for many of the material/technique combinations. Statistical R^2 values were less than 0.5 when the 57th month data were included in the analysis, but increased to over 0.9 when these data were omitted. Overall, the exponential model was very sensitive to the collected data.

The forecasted values for the winter season from the Winter's model were averaged with the results of the exponential model. Using this method, predictions of useful life were determined by the first season that a particular material/technique combination reached 50 percent failure. Figure 9 shows the final output of the eclectic model which averages the results from the Winter's forecasting model with those from the exponential model for the Crafco 522 and Band-Aid combination. Similar results to those found in Figures 8 and 9 for all the material/combinations used at the Helena test site are provided in Appendix M.

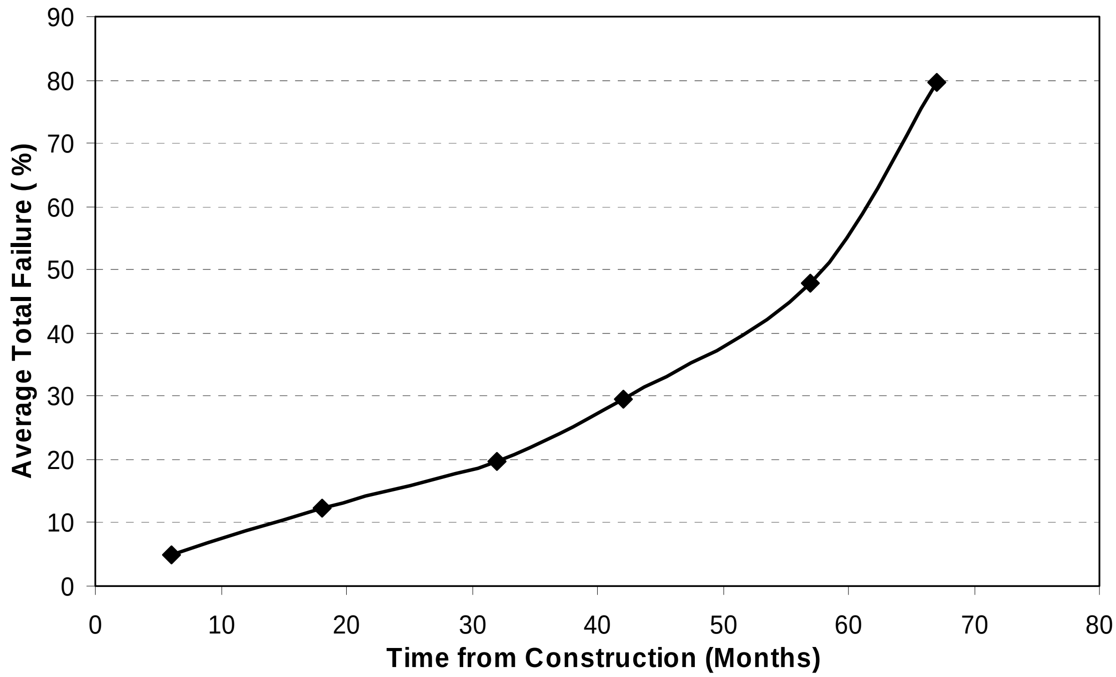

Figure 9: Eclectic Forecasting Results for Crafco 522, BA

An attempt to use this and other simple exponential models for the Dutton and Tarkio sites resulted in unreasonable estimates of useful service life. Consequently, the eclectic forecasting was only incorporated using Helena data, and only relative performance estimates can be made based on current data for the remaining sites. Table 21 shows total failure for all of the evaluations performed to-date. Also included in this table is the forecasted life of each of the material/technique combinations.

Table 21: Evaluation Results with Forecasted Life Expectancies for the Helena Test Site

Material	Technique	Total Failure (%)									Forecasted Life (*mo.*)
		2 mo.	*6 mo.*	*11 mo.*	*23 mo.*	*32 mo.*	*37 mo.*	*42 mo.*	*48 mo.*	*57 mo.*	
Deery 101	B-A	0	56.1	1.7	1.7	99.1	3.8	98	7.5	59.8	6**
	SH-F	0.3	2.5	2	2.1	49.7	6.5	29.8	10.9	59.3	32**
	SQ-BA	0.1	4.3	2.4	2.7	60	6	61.4	8.7	56.1	32**
	SQ-F	0.7	4.9	2.8	4.3	77.6	7.7	71.7	37.5	64.7	32**
	SQ-R	6.2	22.1	19.8	35.9	75.6	33.8	66.4	27.2	58	32**
Crafco 231	B-A	0	3.6	1.3	2.1	37.9	3.2	69.6*	15.1	48.5	45**
	SH-F	3.9	6.6	6.6	6	9.5	10	11.2*	7.4	8.2	139
	SQ-BA	0.1	3	1.1	2.5	5.5	6.6	8.7*	2.7	4.3	103
	SQ-F	1.9	10.8	9.5	6.8	13	9.5	10.6*	14.5	12.1	103
	SQ-R	4.4	16.5	14.6	15.7	21.7	16	29.1*	17.2	27.5	79
Maxwell 72	B-A	0	49.4	3.5	4.1	95.3	41.5	99.0*	60.2	97.9	32**
	SH-F	0.5	4.4	3.3	3.6	6.5	4.4	7.2*	6.2	4.9	127
	SQ-BA	2.1	14.5	5.3	5.4	84.7	17.6	19.3*	11.3	12.3	32**
	SQ-F	2.4	7.3	4.4	4.3	12.7	7.2	19.0*	7.7	10.4	91
	SQ-R	2.2	20.4	14.1	17.6	50.6	35.7	50.7*	16.6	45.7	32**
Crafco 522	B-A	0	4.5	1	2.1	19	4.3	26.2	12.2	47.3	67
	SH-F	1.2	5.9	3.1	3.8	6	5.6	8.3	5.4	8.3	151
	SQ-BA	0.6	4.3	2.8	2.3	6.5	3.4	6.7	5.5	6.9	163
	SQ-F	3.5	9.2	6.1	5.4	10.2	8.2	11.5	9.5	11.5	175
	SQ-R	4.7	16.4	14.4	12.2	24	18.8	25.3	20	30.3	79
Maxwell 71	B-A	0.5	32.7	5.2	7.6	99.8	35.1	99.4	47.4	100	32**
	SH-F	0.4	4.6	2.5	1.9	6.9	2.3	6.5	3	19.2	103
	SQ-BA	0.3	6	1.8	1.4	11.6	2.4	38.8	3.8	50.7	57**
	SQ-F	3.8	10.7	7.1	5.9	16	6	19.4	7.5	33.9	103
	SQ-R	8.1	16.2	17.5	16.3	61.8	16.2	55.9	23.9	44.9	32**

* 42-month evaluation was interrupted by bad weather, so these measurements were taken at 45 months.
** Forecasting life was unnecessary for these since total failure occurred before the end of the evaluation period.

Predictions of useful life were determined by the first season that a particular material/technique combination reached 50 percent failure. In Helena, averaging the forecasted life for specific materials revealed that Crafco 522 provides the longest life, followed by Crafco 231, Maxwell 71, Maxwell 72, and Deery 101, respectively. While these products seem to perform well with a variety of routing techniques, particularly good performance has been noted with the Shallow and Flush, and Square and Flush techniques. The two techniques that offer poor performance when employed with these materials are the Square Reservoir and Recessed and Simple Band-

Aid techniques. These techniques have consistently exhibited poor results with all of the materials evaluated by this research effort.

The conditions of the unsealed cracks in the control test section at the Helena site were also evaluated. As of the final evaluation conducted in May 2003, crack severities were considered to be 0% low severity, 43% moderate severity and 57% high severity, which is very similar to results obtained from previous evaluations. Overall, the portion of the unsealed cracks in the passing lane experienced higher levels of severity than those in the driving lane.

3.4.5 Summary of Condition Survey Results

The four experimental crack sealing sites (Conrad, Dutton, Tarkio and Helena) have been monitored frequently to determine route technique and sealing material performance, and the results are included in this document. Winter evaluations for these sites provided measurements of pavement movements during cold weather events, but did not necessarily coincide with the coldest temperature experienced at these sites.

A statistical review of the distresses seen in transverse cracks at the Conrad site reveals that the Band-Aid and Square Reservoir and Recess configurations experienced the most failures after five years of service. Some test sections with the Band-Aid sealing configuration have high percentages of cohesion failure, while some test sections with the Square Reservoir and Recess configuration have high percentages of adhesion failure and secondary cracking. The Shallow Reservoir and Flush configuration is providing the best performance to date among the different techniques utilized here. In general, Crafco 231 and Maxwell 60 are performing better than Crafco 221 in the transverse cracks. Inspection of the summary for longitudinal cracks at the Conrad site revealed that the three materials performed about the same. Failures in longitudinal cracks were noticeably fewer, relative to the transverse cracks. This is most likely due to smaller thermal movements associated with longitudinal cracks. Considering all crack sealing techniques, the Square Reservoir and Recessed performed the worst. It had high percentages of adhesion failure and secondary cracking. A comparison between secondary cracking for square reservoirs with flush sealant and shallow reservoirs with flush sealant reveals that the shallow reservoirs experienced smaller percentages of this type of failure.

At the Dutton site, a statistical review of the data indicated that with the exception of Crafco 516, the materials are performing similarly and acceptably. Principal failure modes at Dutton for 516 were adhesion failure and secondary cracking in conjunction with the square reservoir; and cohesion failure and secondary cracking with the shallow reservoir. For the remaining three materials (Crafco 231, 299, and 522) secondary cracking was the predominate mode of failure.

The Square Reservoir and Recessed was again the only configuration that experienced significant failure at the Tarkio site. When compared to other techniques at this location, the Square Reservoir and Recessed experienced three or more times the total failure for any given material. However, at this site it must be remembered that the number of cracks available for evaluation was low.

Because Helena data was collected seasonally, differences in cold and warm weather performance were revealed. More specifically, crack sealing at the Helena site followed a cyclic pattern having more failure following cold seasons and less following warm seasons. Higher levels of failure following winter allow greater amounts of water to infiltrate into the pavement structure, which happens to coincide with Montana's wettest time of the year – the spring. Overall, winter failures generally follow an exponential trend, which is consistent with data collected at the Conrad test site.

Crack sealing performance at the Helena site has been quite good overall. At the end of the evaluation, only 12 of the 25 material/technique combinations have reached 50 percent failure. An eclectic forecasting tool was utilized to determine the life expectancy of the remaining 13 test sections. From this analysis it was predicted that 10 of the 13 would have lives of at least 7 years (84 months). Table 22 shows the ranking of these 10 material-technique combinations based on this analysis. Note that this ranking

Table 22: Ranking of Best Material/Technique Combinations at the Helena Test Site Based on the Eclectic Forecasting Analysis

<table>
<tr><th>Rank</th><th>Forecasted Life (months)</th><th>Material-Technique Combo</th></tr>
<tr><td>1</td><td>175</td><td>Crafco 522 & SQ-F</td></tr>
<tr><td>2</td><td>163</td><td>Crafco 522 & SQ-BA</td></tr>
<tr><td>3</td><td>151</td><td>Crafco 522 & SH-F</td></tr>
<tr><td>4</td><td>139</td><td>Crafco 231 & SH-F</td></tr>
<tr><td>5</td><td>127</td><td>Maxwell 72 & SH-F</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">103</td><td>Crafco 231 & SQ-BA</td></tr>
<tr><td>Crafco 231 & SQ-F</td></tr>
<tr><td>Maxwell 71 & SH-F</td></tr>
<tr><td>Maxwell 71 & SQ-F</td></tr>
<tr><td>7</td><td>91</td><td>Maxwell 72 & SQ-F</td></tr>
</table>

The overall life of individual techniques and materials were determined separately by averaging their respective lives. Results showed that Crafco 522 provides the longest forecasted life, followed by Crafco 231, Maxwell 71, Maxwell 72, and Deery 101, respectively. The Shallow and Flush technique provides the longest forecasted life, followed by the Square and Flush, Square and Band-Aid, Square and Recessed, and Simple Band-Aid techniques, respectively.

3.5 Structural Condition Monitoring of Helena Test Site

Pavement evaluations at the Helena (Seiben) site included structural condition monitoring with a JILS falling-weight deflectometer (FWD). The FWD tests apply an impact load to the pavement surface and measure the pavement response in terms of vertical surface deflections. The following sub-sections describe the methodology of FWD testing, the analysis of results received to-date, and conclusions drawn from the analysis. According to a preconstruction soil survey conducted by MDT at the Helena site in October 1993, subgrade soils are generally good and base course materials are excellent. Table 23 shows the soil classifications for borings taken in and around the Helena test site for the base course and subgrade. The liquid limits (LL), plasticity index (PI), in situ moisture content, and R-value are shown for the subgrade soils.

Table 23: Soil classifications for base course and subgrade soils at and near the Helena site

Milepost	Soil Classification		Subgrade Soil Parameters			
	Base Course	Subgrade	LL	PI	Moisture (%)	R-value
209.0	A-1-a (0)	A-1-a (0)	22	2	3.4	68
210.5	A-1-a (0)	A-2-4 (0)	25	6	10.1	11
211.0	A-1-b (0)	A-1-b (0)	22	4	5.7	75
212.0	A-1-a (0)	A-6 (0) / A-2-4 (0)	29	11	10	9
213.0	A-1-a (0)	A-2-4 (0)	24	5	6.6	20
214.0	A-1-a (0)	A-6 (4)	35	69	13.8	-5
215.0	A-1-a (0)	A-2-6 (0)	31	12	6.1	26

3.5.1 FWD Testing Methodology

The load is applied by dropping a mass on a rigid plate with diameter of approximately 12 inches. The magnitude of load is changed by adjusting the drop height for the mass. Deflections are measured at various offset distances from the load on the pavement surface as shown in Figure 10. During a single test, load and deflection are monitored for approximately 100 milliseconds and the maximum value of each is retained for analyses.

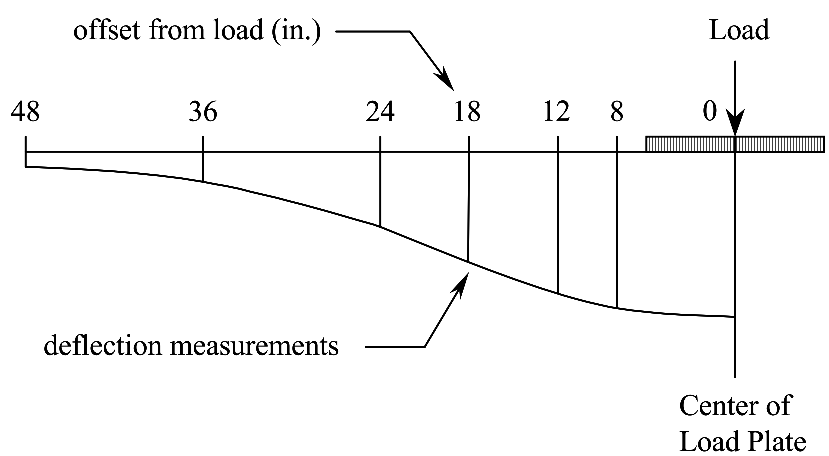

Figure 10: Deflection Basin during a Falling-Weight Deflectometer Test

The most common use of the data is to collect all the deflections shown in Figure 10, thus characterizing the pavement response to load as a "deflection bowl." Then a theoretical multi-layer, linear elastic structure that has the same pavement layer thicknesses as the pavement that was tested by FWD was created. From this, a set of layer moduli for the simulated pavement that would deflect in a manner similar to the real pavement was determined. In other words, the shape of the deflection bowl would be similar, given the applied load. These analyses are typically performed assuming the problem is static (i.e. peak load and peak deflections all occur at the same time). Typically, in the case of asphalt-surfaced pavements, layers are considered to be fully bonded in these analyses. The iterative process of finding the best-fit set of layer moduli is often referred to as "back-calculation."

An additional method of analysis is to characterize the pavement response to load by a stiffness, defined as the ratio of peak load to peak deflection at offset = 0 in., with resulting units of kips/in. Although this simplistic method of data analysis produces less information than the back-calculation method, it does not require any assumptions based on the number of layers or layer thicknesses. Therefore, the simplistic analysis has advantages in cases when thicknesses are unknown or when the number of layers cannot be limited to a manageable number.

At the Helena (Seiben) site, FWD tests were performed every 164 ft (50 m), with all tests in the outside wheel path of the driving (outside) lane. Each test involved four loadings, which were performed sequentially and without substantial delay between drops (approximately 10 seconds). The first drop was considered a "seating load" and the drop height provided loads of 8000 to 10,000 lb. The precise magnitude of the load for any particular test is affected by the pavement stiffness at that location. Drops 2 through 4 (referred to as loads 1 through 3 in the analysis) were conducted in order of increasing height, providing increasing loads. The second drop (load 1) provided a load of 6000 to 7000 lb, the third drop (load 2) provided a load of 7000 to 9000 lb, and the fourth drop (load 3) provided a load of 9000 to 11,000 lb.

3.5.2 Structural Condition Monitoring – Results

The structural condition of all test sections has been evaluated on seven different dates, spanning from September 17, 1998 to May 13, 2003. Table 24 shows the dates when data was collected. The FWD test results of interest for this experiment include:

1. pavement stiffness (units = kips/in.),
2. back-calculated modulus of asphalt concrete (units = ksi),
3. back-calculated modulus of base course (units = ksi), and
4. back-calculated modulus of subgrade (units = ksi).

These data are summarized for all test sections and for all test dates in Appendix L.

Table 24: History of FWD Testing at the Helena Test Site

Test Number	Date Conducted
Number 1	September 17, 1998
Number 2	April 21, 1999
Number 3	August 11, 1999
Number 4	May 11, 2000
Number 5	September 26, 2000
Number 6	April 10, 2001
Number 7	October 2, 2001
Number 8	April 29, 2002
Number 9	September 4, 2002
Number 10	May 13, 2003

Because each test section is 0.2 miles long and FWD tests were performed every 164 ft (50 m), one would expect six or seven FWD tests per test section. However, some data were deemed unusable by MDT's Automated Deflection Analysis Program (ADAP) software and were filtered out of the data summary files. The reasons that data could be deemed unusable include:

1. very small deflections (too small to decipher from noise),
2. very large deflections (outside the reliable working range of deflection gages),
3. deflections do not decrease with increasing offset distance (unrealistic results), or
4. back-calculated pavement layer moduli do not decrease with depth (simulated structure is outside the realm of structures that are appropriate for the back-calculation algorithms).

Due to the filtering process, some test sections on some dates ended up with no data for a particular load level. For the seating load, this occurred for six test section/date combinations out of the total of 260 test section/date combinations. For drops 2, 3, and 4 (loads 1, 2, and 3, respectively) this occurred on 88, 8, and 8 test section/date combinations, respectively. Due to the excessive quantity of filtered data, load 1 will not be used in this analysis of results. Also, the seating load (i.e., drop 1) will not be considered in this analysis of results because its purpose is simply to ensure that the load plate is flush with the pavement surface during the subsequent loadings.

For the crack sealing experiment, the most important information to be extracted from FWD test results was considered to be changes in structural condition over time. Therefore, to begin the analysis, data were organized by test date and the FWD results were summarized as changes in pavement response (stiffness and pavement layer moduli) with respect to the first test date of

September 17, 1998. All FWD tests within a test section and on a particular date were considered replicates of equal value and were therefore averaged.

To determine whether loads 2 and 3 (drops 3 and 4, respectively) were providing substantially different information, the four FWD test results listed earlier (pavement stiffness, asphalt concrete modulus, base course modulus, and subgrade modulus) were analyzed for correlation and significant differences. To demonstrate correlations, measured percent changes in pavement response from the initial test date (September 17, 1998) for loads 2 and 3 are plotted against each other in Figures 11 through 14. The figures include all available data for all test sections and all evaluation dates (i.e., 260 data points). The figures show that the correlations between results for loads 2 and 3 are very strong for each pavement stiffness, asphalt modulus, and base modulus. The correlation was weaker for subgrade modulus. These four correlations were found to be statistically significant, as shown in Table 25.

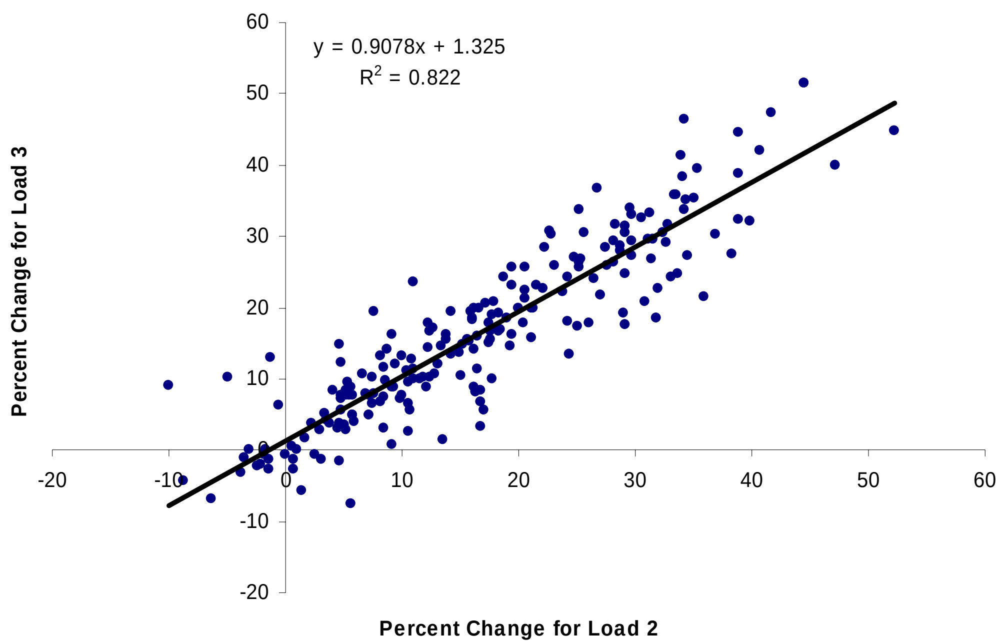

Figure 11: Percent Change in Pavement Stiffness from Initial Test Date

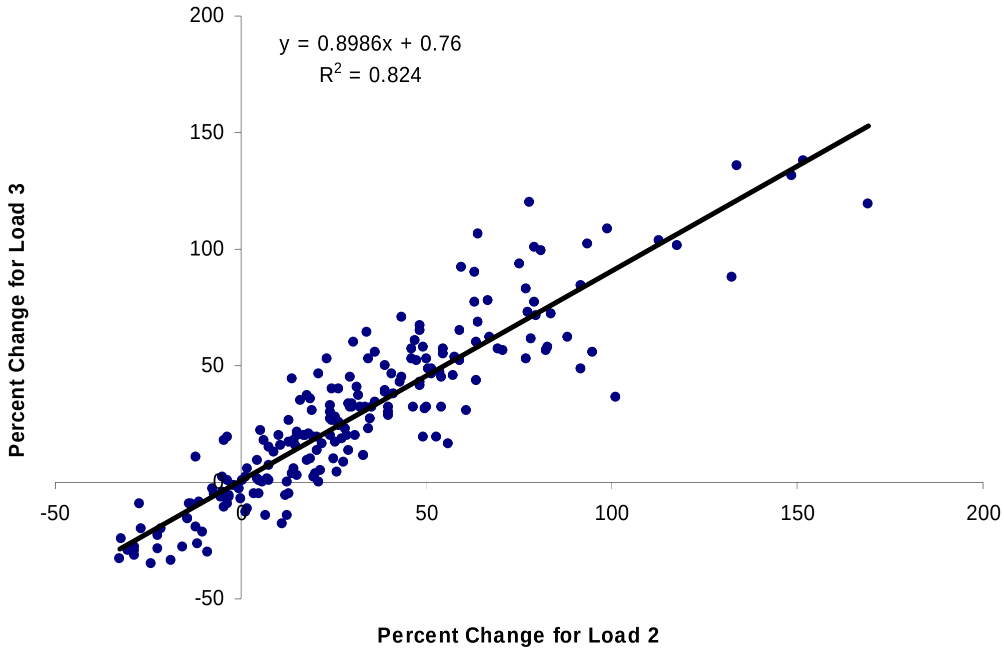

Figure 12: Percent Change in Asphalt Concrete Modulus from Initial Test Date

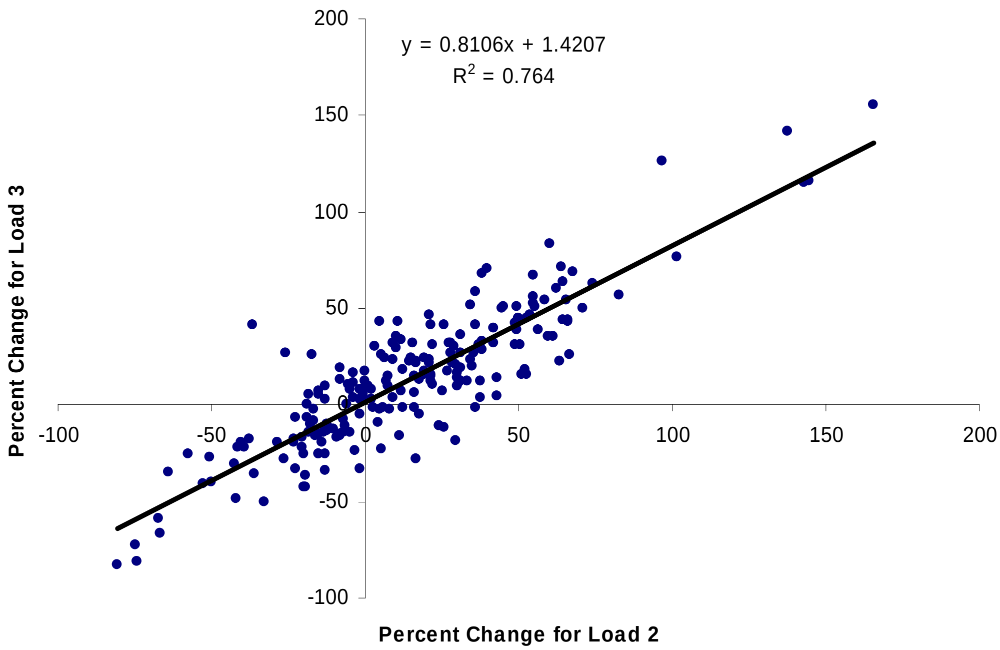

Figure 13: Percent Change in Base Course Modulus from Initial Test Date

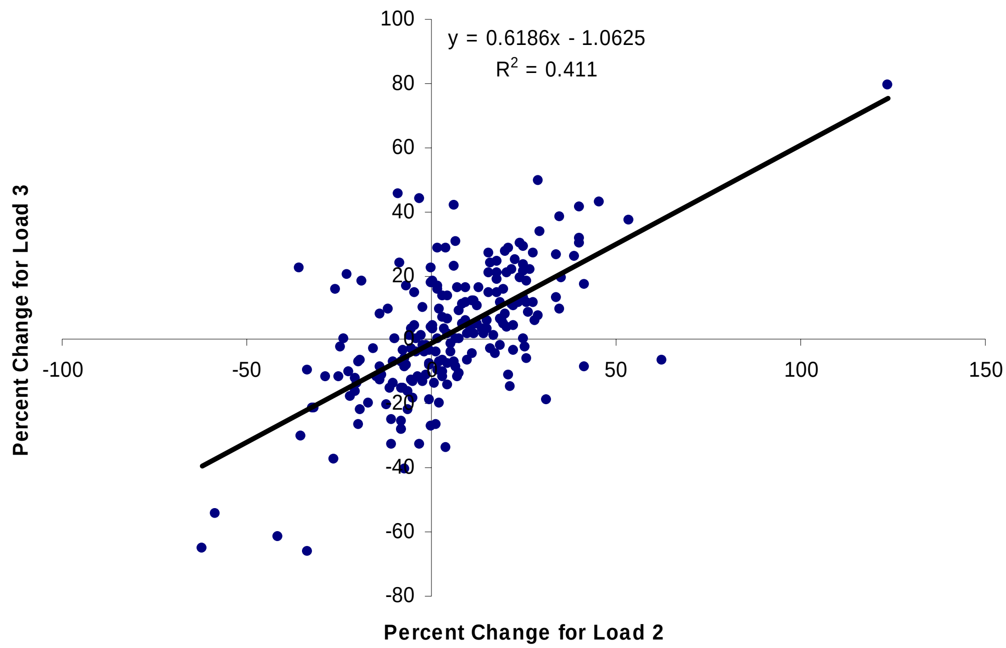

Figure 14: Percent Change in Subgrade Modulus from Initial Test Date

Table 25: Correlations and Comparisons between Loads 2 and 3

FWD Parameter*	Correlation		Paired t-Test (2-tail)		
	Coefficient	P-value**	Mean Difference†	Student's t-value	P-value**
Pavement Stiffness (kip/in.)	0.907	0.000	0.23%	0.640	0.523
Asphalt Concrete Modulus	0.908	0.000	2.33%	2.216	0.028
Base Course Modulus	0.874	0.000	1.30%	1.205	0.307
Subgrade Modulus	0.641	0.000	3.06%	2.584	0.010

* Units of percent change were used in the comparisons and correlations.
** P-value = the probability that a correlation or difference is not significant.
† Percent change in response; Load 2 minus Load 3.

Given the strong correlations and the small differences between pavement responses, as measured by loads 2 and 3, the analyses were continued with only one load level. Load 2 was chosen because on the first date of FWD analyses, no data were retained for load 3 in test section E5 (Maxwell 71, SQ-BA). On this particular date, all data at load level 3 in that test section failed the ADAP filtering criteria. As such, all remaining analyses will be concerned only with load level 2.

The next stage of the analysis was to determine significant differences between the sealed test sections and the unsealed control test section. The purpose of this analysis was to determine whether the unsealed section was losing structural integrity at a greater rate than the sealed sections. The average FWD parameter data for the unsealed control test section (Load Level 2), as well as the corresponding percent changes, are shown in Figures 15 through 18. An important observation from these figures is that stiffness and moduli generally increased over the evaluation time period. This is at least partially attributable to increased stiffness (i.e., age hardening) of asphalt concrete and perhaps increased cementation of base course materials. Regardless, there is no evidence of decreasing structural integrity for the control test section for which cracks were left unsealed.

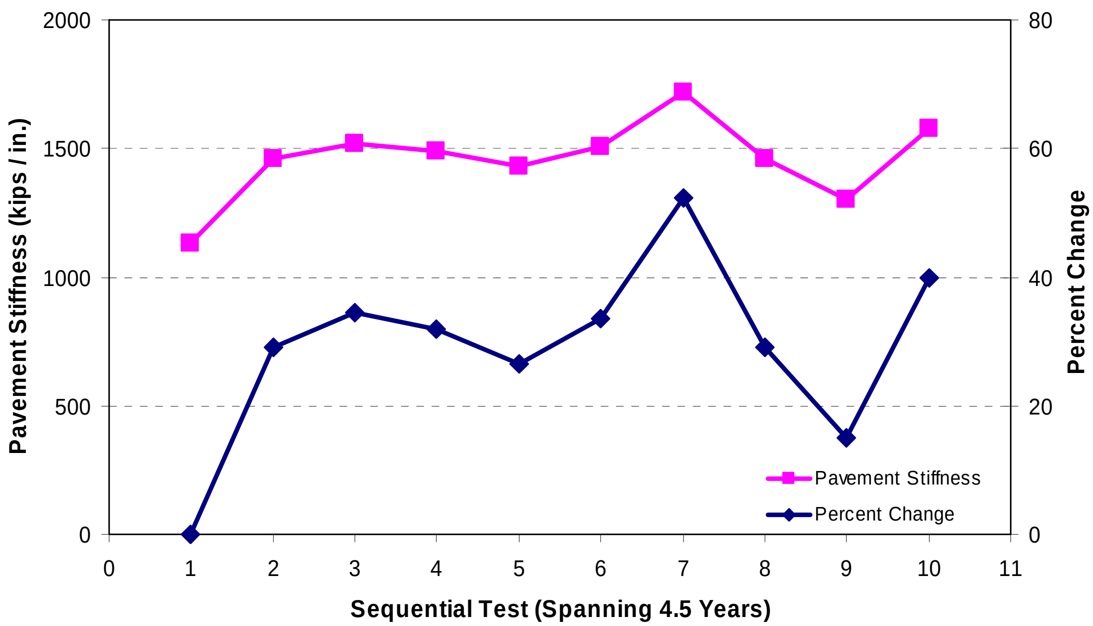

Figure 15: Pavement Stiffness over Time for the Unsealed Control Pavement (Control Section)

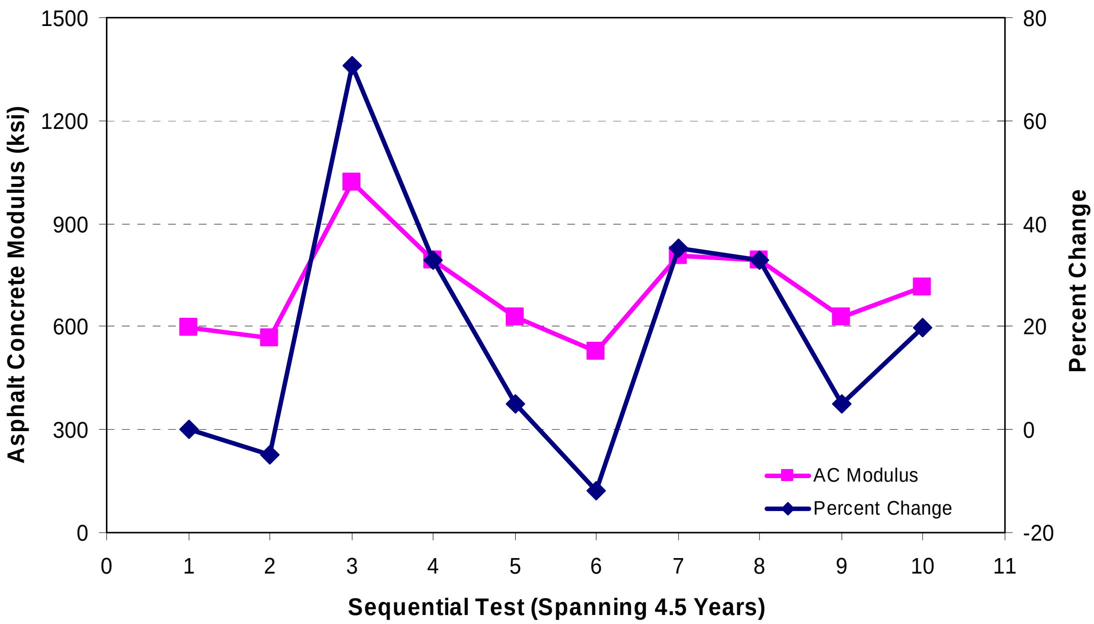

Figure 16: AC Modulus over Time for the Unsealed Control Pavement (Control Section)

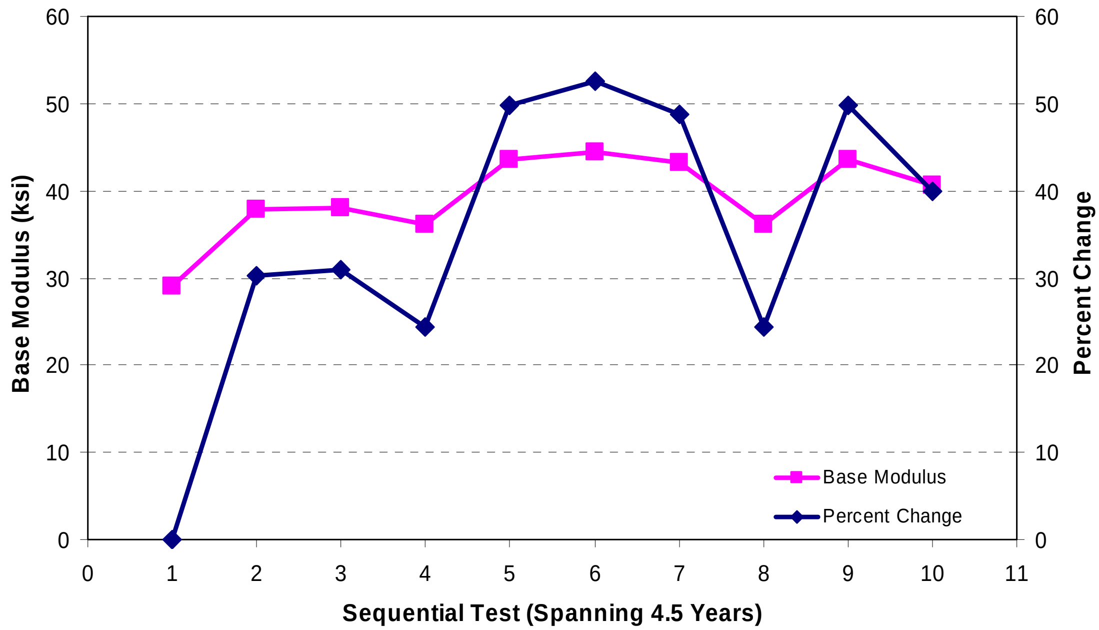

Figure 17: Base Course Modulus over Time for the Unsealed Control Pavement (Control Section)

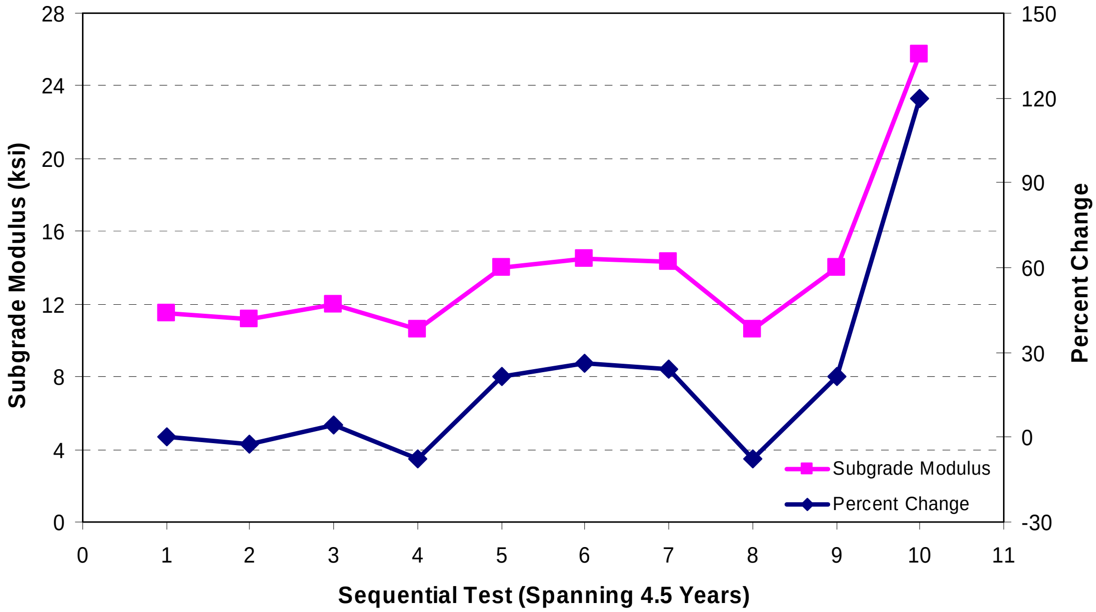

Figure 18: Subgrade Modulus over Time for the Unsealed Control Pavement (Control Section)

Fluctuations in pavement stiffness over time can also be partially correlated with changing pavement surface temperatures at the time of conducting FWD analyses (see Figure 19). For example, temperatures for evaluations 5 and 9 were relatively high, while the temperature for evaluation 7 was relatively low. As such, measured pavement stiffnesses for evaluations 5 and 9 were low relatively to the pavement stiffness measured for evaluation 7 (see Figure 15).

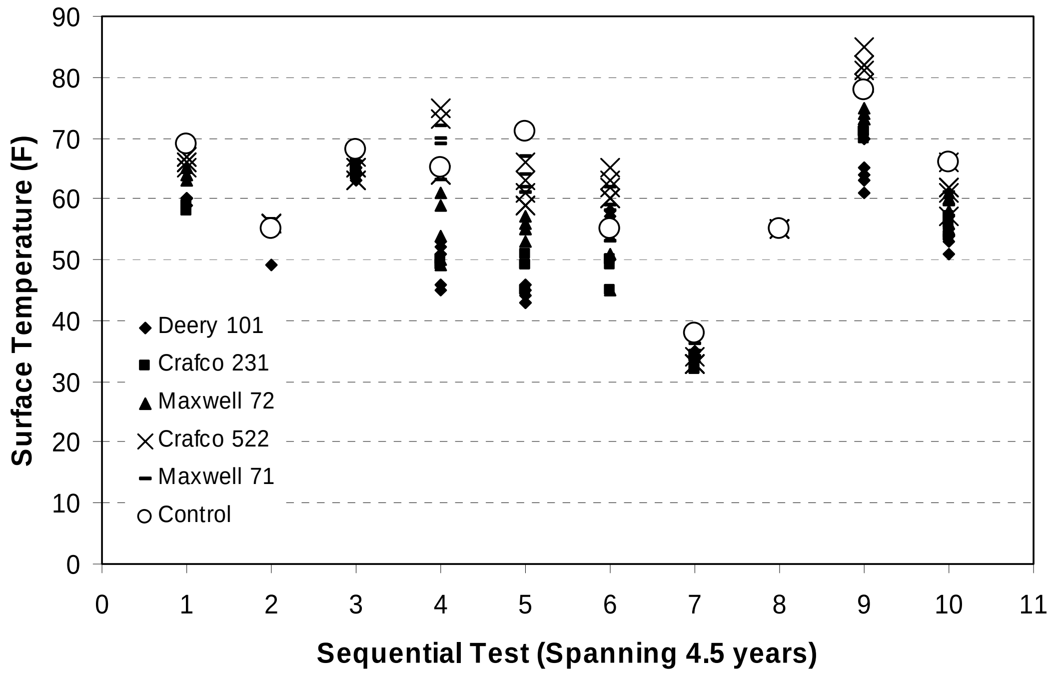

Figure 19: Average Pavement Surface Temperatures

The measured values for the FWD parameters over time for sealed sections are shown in Figures 20 through 23 (responses for the unsealed Control section, Section F, are included for comparison purposes). The sealed and unsealed (i.e. control) sections are similar in that overall pavement stiffness and asphalt concrete modulus generally increased over time (see Figure 11). For example, the percent increases in overall pavement stiffness at the time of the last analysis (i.e., May 2003) for the sealed sections are commensurate with that found for the unsealed section: 20 to 50 percent versus 40 percent.

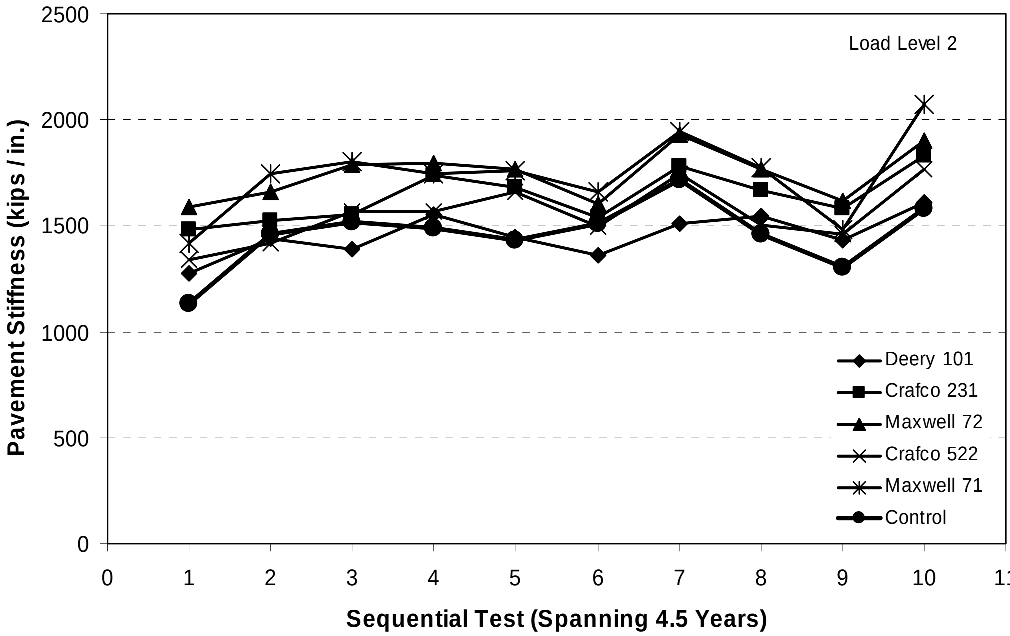

Figure 20: Pavement Stiffness over Time for the Sealed and Unsealed Test Sections

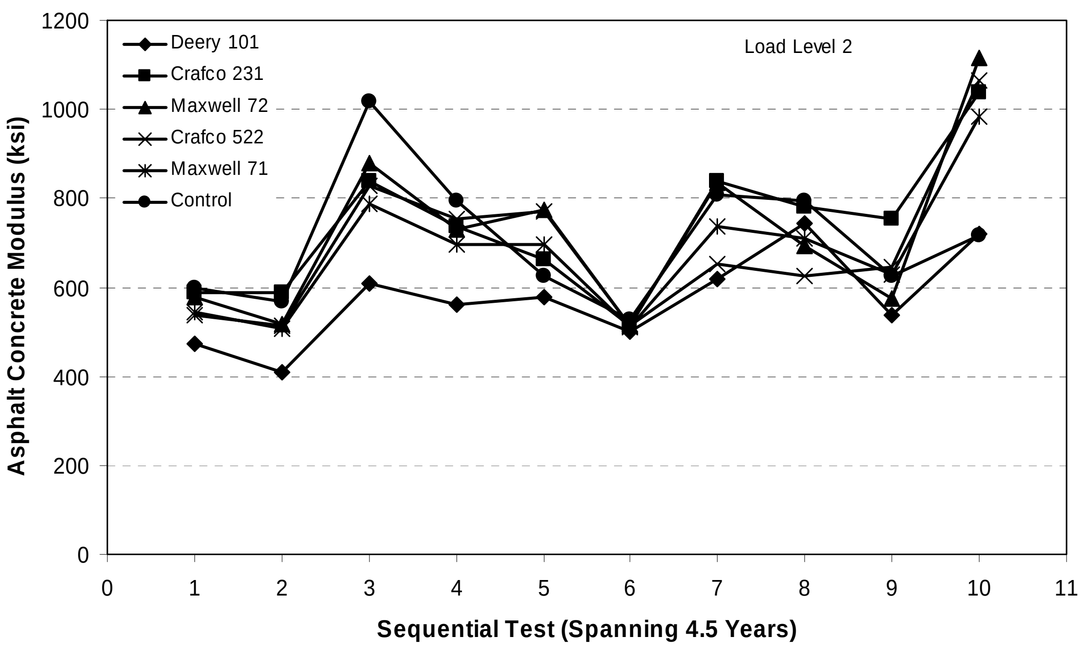

Figure 21: Asphalt Concrete Modulus over Time for the Sealed and Unsealed Test Sections

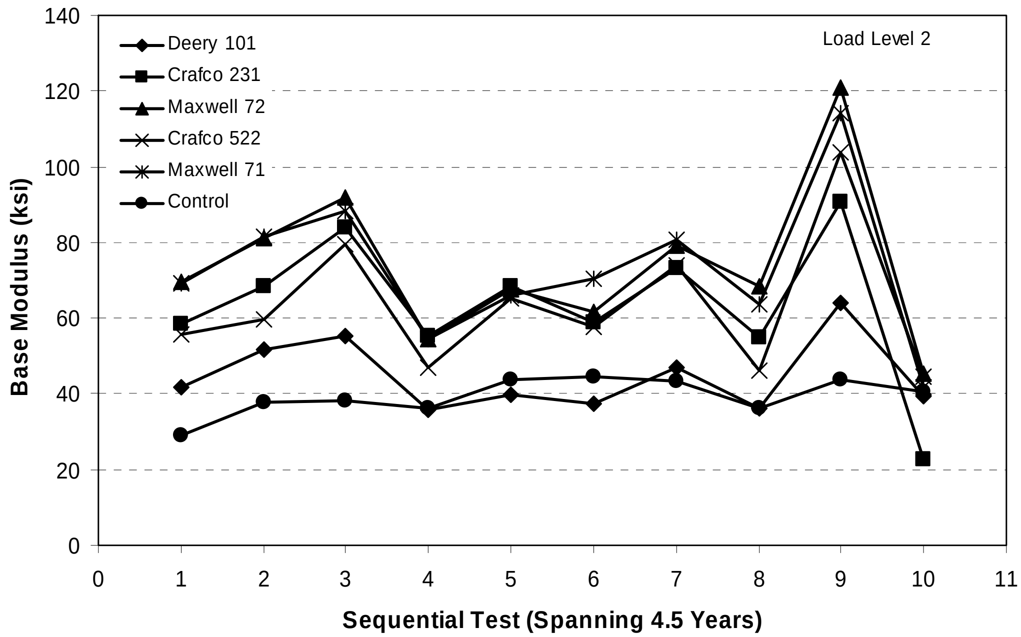

Figure 22: Base Course Modulus over Time for the Sealed and Unsealed Test Sections

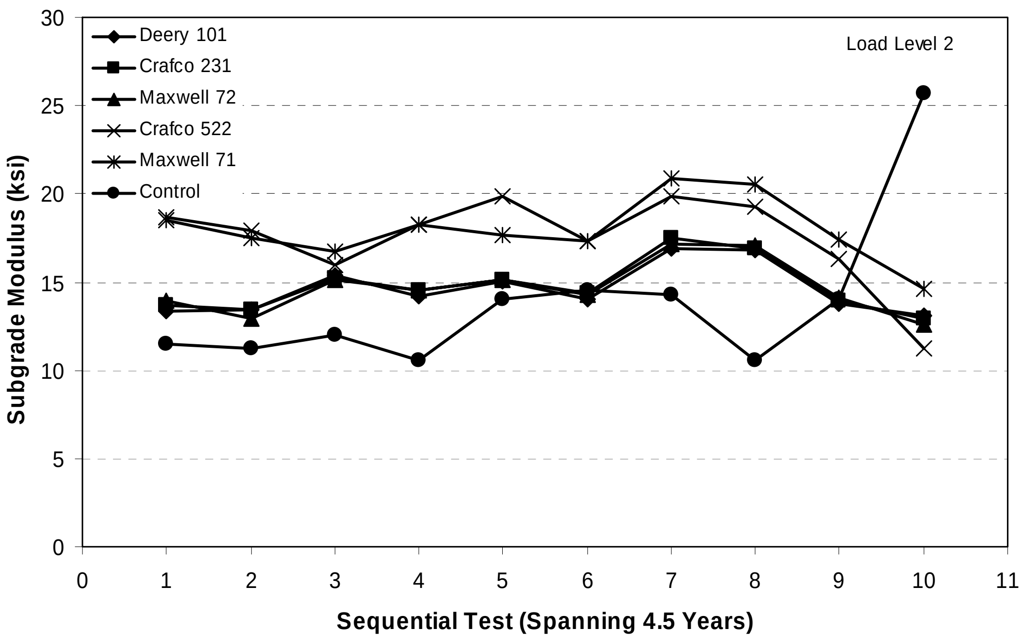

Figure 23: Subgrade Modulus over Time for the Sealed and Unsealed Test Sections

Asphalt concrete moduli generally increased over time for all pavement sections. Temperature fluctuations over time caused the asphalt concrete moduli to fluctuate between 400 and 1000 ksi. At the time of the last analysis (i.e., May 13, 2003), the modulus of the unsealed control section had increased 20 percent relative to the initial test date (September 17, 1998) and the sealed section moduli had increased 50 to 150 percent (see Figure 21). As expected, AC becomes more brittle over time thereby showing greater modulus. Nevertheless, it is not known why there was less increase in modulus in the control section.

Base and subgrade moduli generally increased over time for the unsealed control section. The base demonstrated a slow and steady increase from 30 ksi to 40 ksi. The subgrade demonstrated an uncharacteristic jump in modulus during the last eight months of the evaluation period, increasing from 14 ksi to 26 ksi. This jump cannot be explained but the calculated modulus was similar for two different load levels which each had three test locations. Meanwhile, the sealed sections showed relatively little change in base or subgrade moduli until the last eight to thirteen months of the evaluation period. During the last thirteen months, subgrade moduli decreased slightly from approximately 20 ksi to approximately 15 ksi. During the last eight months, the most common change in base moduli for sealed sections was from approximately 100 ksi to 40 ksi.

The decreases in base and subgrade moduli for the sealed sections should not be considered as significant indications of structural softening or deterioration for several reasons.

1. There is no logical engineering reason to support the hypothesis that sealing cracks weakens sub-layers within pavements.
2. Overall pavement stiffness increased over time for all test sections (see Figure 20).
3. Base and subgrade moduli fluctuate over wide ranges over time (see Figures 22 and 23). The recent decreases in moduli are likely small increments within these fluctuations.
4. In back-calculation procedures, the moduli of multiple layers are not independent. In order to minimize errors between measured and predicted deflection basins, an increase in modulus for one layer must often be accompanied by decreases in other layers. For the sealed sections, asphalt concrete moduli increased by approximately 40 percent during the last eight months of the evaluation.
5. The variability in back-calculated moduli, as measured between the different test locations in each test section, were particularly high for the last test date (see Figures 24 through 27). High variability between measurements necessitates relatively large differences in mean values in order for the differences to be considered statistically significant.

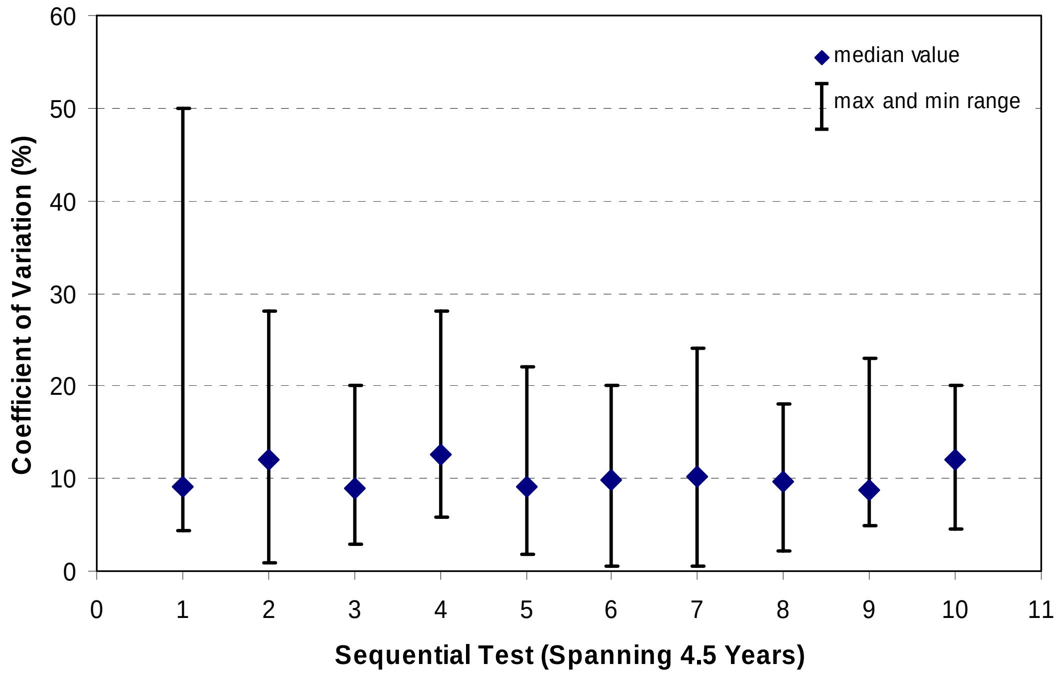

Figure 24: Variability in Pavement Stiffness between Tests within Test Sections.

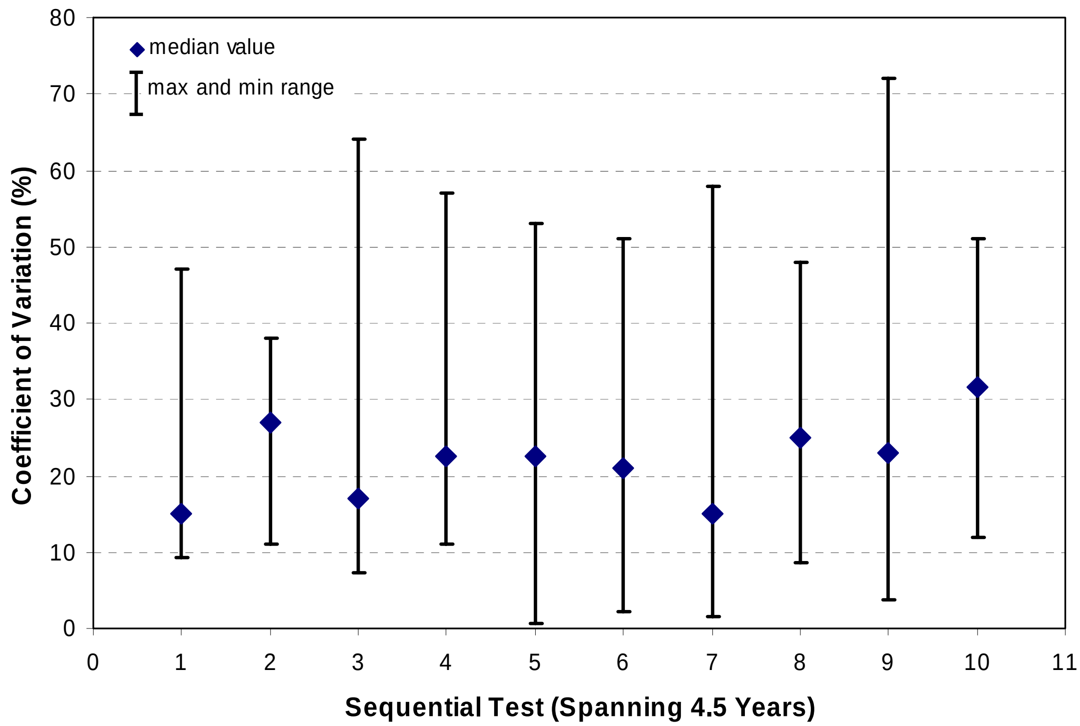

Figure 25: Variability in Asphalt Concrete Modulus between Tests within Test Sections.

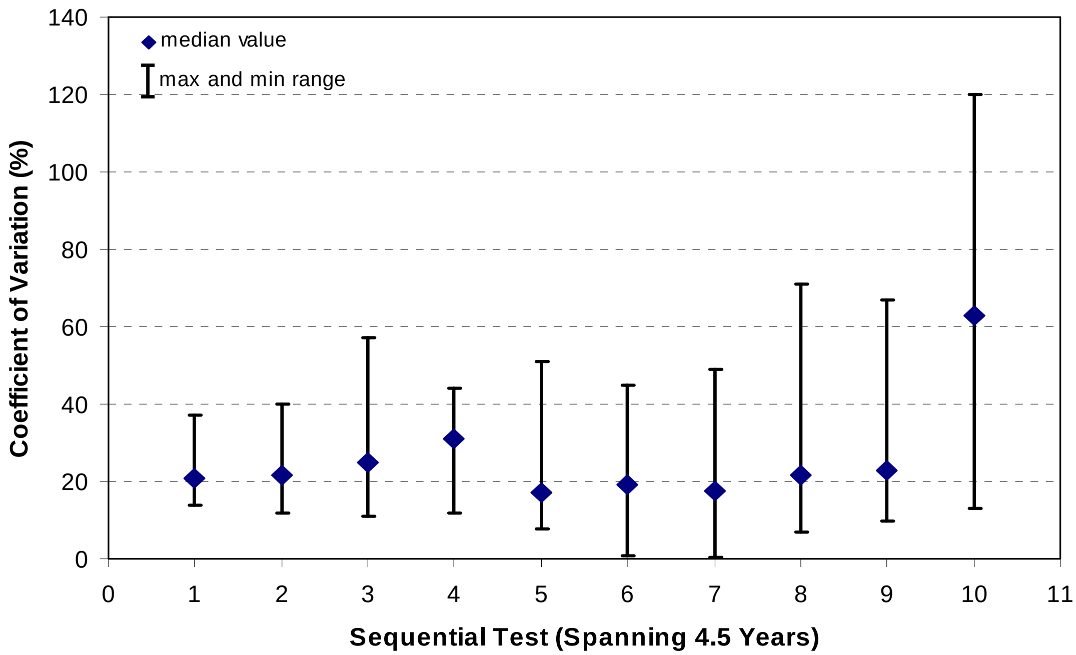

Figure 26: Variability in Base Course Modulus between Tests within Test Sections.

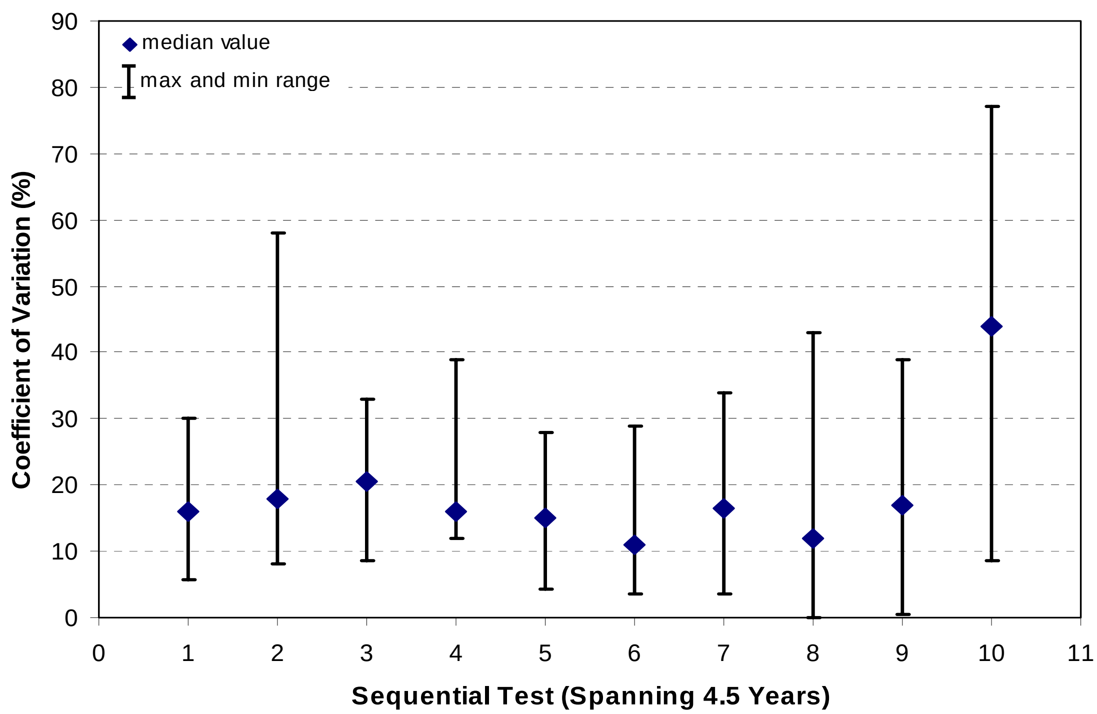

Figure 27: Variability in Subgrade Modulus between Tests within Test Sections.

Given the complications just presented, monitoring overall pavement stiffness (as determined by FWD) is most likely the best alternative for identifying pavement sections that are experiencing structural deterioration (or severe softening during seasons of high moisture). Attempts to monitor changes in moduli for individual layers are hindered by the interdependencies between back-calculated moduli, the substantial effects of temperature, and the inaccuracies associated with assumed pavement thicknesses. Therefore, given the similarities in changing pavement stiffness over time for the unsealed section (see Figure 15) and the sealed sections (see Figure 20), the authors conclude that there is insufficient evidence at the Helena site to state that failure to seal cracks either accelerates structural deterioration or accentuates structural softening during wet conditions. This conclusion is specific to the Helena site and is based on only 4.5 years of pavement monitoring.

The final objective of the FWD analyses was to investigate potential differences in structural durability for the sealed sections. The premise was that differences might reside between sealing materials and/or sealing techniques in terms of their abilities to maintain pavement structural integrity. Based on the fact that data did not show poorer pavement integrity for the unsealed sections, one would not expect to find significant differences to be caused by sealing materials or sealing techniques. However, the analysis was conducted for completeness and for the purpose of substantiating the previous findings related to structural deterioration.

This analysis concentrated on overall pavement stiffness measurements for both the initial evaluation and the ninth evaluation (September 4, 2002). The ninth evaluation was selected for this analysis for two important reasons:

1. air and mat temperatures were similar to those found on the initial test date of September 17, 1998 (see Figure 19); and
2. pavement stiffnesses were relatively low (likely due to a combination of moisture and temperature), thus providing a worst-case pavement condition.

Tables 26 through 28 summarize average stiffness measurements on the initial test date (September 17, 1998), average stiffness measurements on the ninth evaluation date (September 4, 2002), and average percent changes in pavement stiffness between these same two dates, respectively. Neither initial pavement stiffnesses (Table 26) nor pavement stiffness at the ninth evaluation (Table 27) vary substantially between sealant material or sealing technique. Average values over each material and technique for Tables 26 and 27 produce ranges of 1270 to 1590 ksi and 1430 to 1620 ksi, respectively. Two important observations related to these ranges in pavement stiffness follow.

1. Both the minimum and maximum values increase over time, indicating that the experimental pavement sections are not deteriorating.
2. For both dates, test sections containing the Deery 101 material established the minimum average stiffness and test sections containing the Maxwell 72 material

established the maximum average stiffness. This indicates that the various test sections are following similar trends with time in terms of their response to load.

Table 26: Average Pavement Stiffness for Sealed Sections on the Initial Test Date (Sept. 17, 1998)

Sealing Technique	Material Type					*Average*
	Deery 101	Crafco 231	Maxwell 72	Crafco 522	Maxwell 71	
SQ-F	1030	1580	1480	1370	1420	*1376*
SH-F	1310	1380	1620	1460	1440	*1442*
SQ-BA	1400	1450	1410	1320	1200	*1356*
SQ-R	1540	1600	1720	1070	1310	*1448*
Band-Aid	1080	1400	1700	1470	1710	*1472*
Average	*1272*	*1482*	*1586*	*1338*	*1416*	*1419*

Stiffness is in units of ksi

Table 27: Average Pavement Stiffness for Sealed Sections on the Ninth Test Date (Sept. 4, 2002)

Sealing Technique	Material Type					*Average*
	Deery 101	Crafco 231	Maxwell 72	Crafco 522	Maxwell 71	
SQ-F	1221	1708	No data	1460	1440	*1457*
SH-F	1419	1543	1634	1620	1550	*1553*
SQ-BA	1476	1532	1394	1480	1490	*1474*
SQ-R	1624	1592	1745	1250	1370	*1516*
Band-Aid	1423	1540	1697	1480	1560	*1540*
Average	*1433*	*1583*	*1618*	*1458*	*1482*	*1510*

Stiffness is in units of ksi

Average changes in stiffness range from 0.3 to 13.9 percent. Table 28 summarizes the changes in stiffness with time for the various pavement test sections. The smallest positive average change (0.3 %) corresponds to the test sections containing the Maxwell 72 material and the largest positive average change (13.9 %) corresponds to test sections containing the Deery 101 material. The test sections that demonstrated the largest average increase in stiffness started with the smallest average stiffness. Likewise, the test section that demonstrated the smallest average increase in stiffness started with the largest average stiffness. All these observations do not support any conclusions related to unequal pavement deterioration or unequal pavement softening as a result of moisture.

Table 28: Average Percent Change in Pavement Stiffness for Sealed Sections from the Initial Test Date to the Ninth Evaluation Date.

Sealing Technique	Material Type					*Average*
	Deery 101	Crafco 231	Maxwell 72	Crafco 522	Maxwell 71	
SQ-F	18.5	8.1	No data	6.6	1.4	*8.7*
SH-F	8.3	11.8	0.9	11.0	7.6	*7.9*
SQ-BA	5.4	5.7	-1.1	12.1	24.2	*9.2*
SQ-R	5.5	-0.5	1.5	16.8	4.6	*5.6*
Band-Aid	31.8	10.0	-0.2	0.7	-8.8	*6.7*
Average	*13.9*	*7.0*	*0.3*	*9.4*	*5.8*	*7.6*

3.5.3 Structural Condition Monitoring – Conclusions

All of the test sections including both sealed and unsealed pavements have remained in good structural condition relative to their conditions at the beginning of this experiment. Therefore, structural evaluations did not prove an advantage for any particular sealing technique or sealing material. Similarly, structural evaluations did not prove the benefit of sealing cracks in asphalt pavements at all (i.e., sealing versus leaving the cracks unsealed). In this case, the economic benefits of sealing cracks and the economic benefits of particular combinations of materials and sealing techniques could only be evaluated through visual condition surveys of the pavement surfaces. That is, some combinations of materials and sealing techniques improved the durability of asphalt pavement surfaces sufficiently to be of overall economical benefit.

Overall, the Helena test site is well built, generally having good subgrade and excellent base materials and experiences relatively low traffic. Moreover, saturation of base and sub-base layers is rare due to low precipitation levels in the area. As such, significant differences between sealed and unsealed test sections is consistent. Over a long period of time, however, differences may begin to emerge, but without monitoring this area for several more years and possibly decades, these differences will remain unknown.

3.6 Pavement Roughness

In general, it has been thought that sealing cracks will help maintain an acceptable level of pavement roughness by safeguarding them from water-related deterioration. In many cases, distresses like cupping and lipping have been observed when water was allowed to infiltrate into the pavement structure. These distresses produce obvious vertical irregularities that will increase the roughness of the road surface. The standard index that describes a pavement's roughness is the International Roughness Index (IRI).

IRI is defined as the roughness of a road surface based on the response of a generic motor vehicle. It is determined by 1) accurately measuring of the profile of the road, 2) processing it through an algorithm that simulates the way a reference vehicle would respond to the roughness inputs, and 3) accumulating the suspension travel (Gillespie, 1992). Measuring systems used today quantify roughness by measuring vertical deviations over a particular section of road in inches per mile. The American Society of Testing and Materials (ASTM) standard for this test is ASTM E867.

Montana Department of Transportation annually measures roughness on their roads to estimate IRI. Originally, the scope of this project did not anticipate using ride quality as one of the measures of the effectiveness of crack sealing, but seeing that there were no structural differences between the sealed and unsealed test sections in Helena, it was thought that it may offer some additional insight into the effects (either positive or negative) of crack sealing.

Annual data collected by MDT were analyzed to determine if there were any significant differences in IRI between the sealed and unsealed test sections at the Helena site. IRI data spanned from 1997 to 2003. The actual dates that this data was collected were:

- September 17, 1997;
- Unknown date, 1998;
- May 25, 1999;
- March 30, 2000;
- April 19, 2001;
- March 27, 2002; and
- March 20, 2003.

IRI was reported in 1/10th mile increments along the entire test section in Helena for the driving and passing lanes for each of these years. These values were averaged for each year for each of the six test sections, that is, the five material/techniques combinations and the control test section. The control test section was 2/10th of a mile long and thus was the average of two IRI values, while the sealed sections were 1 mile long and contained ten IRI values. Results showed that while IRI was generally higher for the passing lane, there were no appreciable differences in IRI between the sealed and unsealed test sections. In fact, IRI for the control section was the lowest out of all the materials in the passing lane. Figures 28 and 29 show IRI for the various test sections in the driving and passing lanes, respectively.

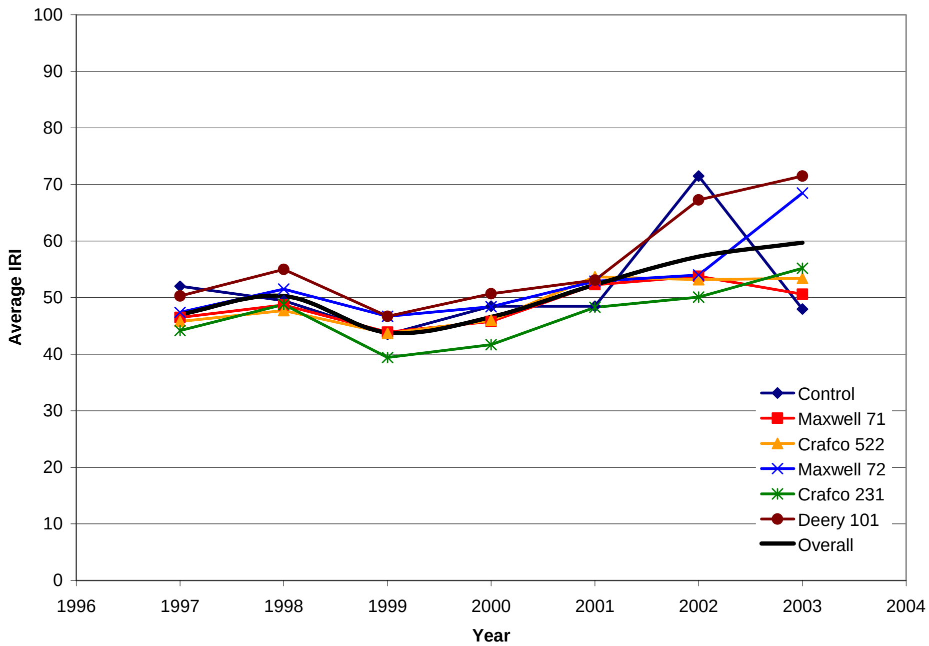

Figure 28: Average IRI of the Driving Lane for the Helena Test Sections

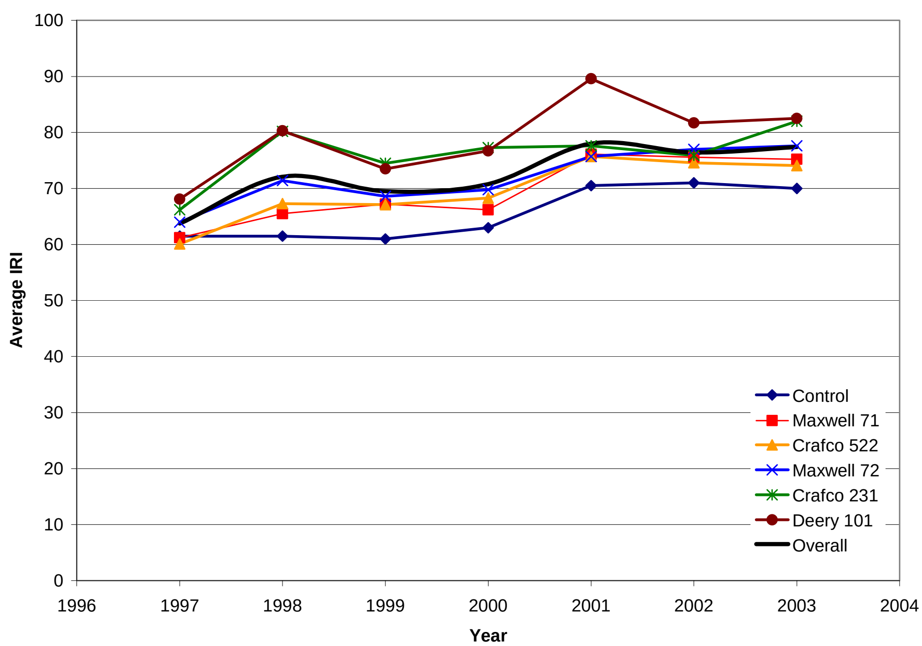

Figure 29: Average IRI of the Passing Lane for the Helena Test Sections

4 COST-EFFECTIVENESS ANALYSIS

Traditionally, crack sealing has been an accepted maintenance treatment used by many Departments of Transportation to prevent water from penetrating the pavement surface and reducing the integrity of the pavement structure. Clear, quantitative assessments of whether crack sealing indeed slows the deterioration of the pavement structure are rare and limited. In a literature review conducted by Hand et al (2000), 100 potential references regarding crack sealing were collected and reviewed. Only 18 of these references were found to specifically address cost-effectiveness of joint and/or crack sealing relative to pavement performance, and only four of the 18 contained valuable quantitative data. Furthermore, many of these studies, similar to this one, have focused on the performance of material/technique combinations rather than cost-effectiveness. In addition to the literature review, Hand and his colleagues interviewed recognized experts in this area to investigate the quality and usefulness of current research. Overall, from their interviews and literature review they concluded that "all of these efforts revealed little quantitative evidence to prove the cost-effectiveness of joint/crack sealing" (Hand et al, 2000). However, more recently, tight budgets have pressed Departments of Transportation to investigate and determine the cost-effectiveness of various maintenance and construction activities. Unfortunately, such investigations can take a long time to yield useful results, as considerable time may pass before treatments exhibit statistically significant differences in structural strength or serviceability. A study was recently conducted by the Joint Transportation Research Program (JTRP) at Purdue to investigate joint/crack sealing issues. Specifically, its objective was to determine whether 1) joint/crack sealing improves the service life or serviceability of pavements (i.e., its performance), and 2) in what situations is it cost effective (assuming that it provides improved performance) (Fang et al, 2003). Because the test sites in Indiana have been monitored for only a short time (two years), the results showed no differences in performance between sealed and unsealed test sections, regardless of pavement type, drainage conditions or road classification. This result was based on multiple performance variables, including: International Roughness Index (IRI), Falling Weight Deflectometer (FWD), load transfer, individual pavement distresses (from condition surveys) and physical and mechanical properties of pavement cores (Fang et al, 2003). Other studies were also consulted to generate ideas on how to best conduct an appropriate cost-effectiveness analysis of crack sealing including: Hall et al (2003), Labi et al (2003), Rajagopal et al (2003), and Tighe et al (2003).

Like many other projects, superior pavement performance based on ride quality and structural strength were not realized from the crack sealed test sections at the Helena site. Even though these results indicated that crack sealing flexible pavements did not enhance performance, more time is needed to verify this conclusion. In order to conduct a life-cycle cost analysis, differences between the crack sealed test sections and the control section must be demonstrated. Consequently, it was more appropriate to conduct a cost-effectiveness analysis to determine which of the crack sealing materials and techniques would be most cost-effective assuming that they will eventually enhance pavement performance.

4.1 Cost Information

Material and labor costs are needed to determine which materials and techniques are most cost-effective for sealing cracks in Montana. Bid documents, interviews with crack sealing contractors, and crack sealant material vendors were consulted to ascertain the total cost of crack sealing. Relative performance of the various material/fill-technique combinations was estimated from the seasonal evaluation of field test sites.

4.2 Overall Cost of Installing Crack Sealant

Crack sealing costs were estimated based on the standard method for sealing cracks in Montana (Shallow and Flush method) using bid documents collected from MDT. Costs for other techniques were extrapolated based on industry estimates provided by contractors. Fourteen crack sealing bids from the six month period spanning from February 2003 to July 2003 were consulted to estimate the cost of crack sealing. These bid documents provided costs in terms of price per linear foot of crack sealing and lump sum amounts for mobilization and traffic control. Four Montana contractors consistently won bids to conduct crack sealing within the six-month period from which this information was obtained. Therefore, a mean bid price was determined by averaging only the winning bids for the 14 crack sealing jobs. Mobilization and traffic control were included in the mean price. This analysis resulted in an average price of $1.60 per linear foot (lf) for the Shallow and Flush method – Montana's standard crack sealing technique.

To augment this information, surveys were sent to several Montana contractors to determine how much they would charge to seal cracks using techniques other than the standard Shallow and Flush method. The three contractors that responded provided sufficient information to be able to estimate differences in cost for other techniques relative to the Shallow and Flush method. The Band-Aid and the Capped techniques were, on average, approximately 25 percent <u>less</u> expensive; and that the square-routed reservoir combined with the Flush, Recessed or Band-Aid filling method were approximately 3 percent <u>more</u> expensive. Absolute prices for these techniques were estimated based on these differences in cost, and they are reported in Table 29. In addition, the coverage of each technique differs because of the cross-sectional area that needs to be filled. Table 29 also shows the estimated coverage in linear feet per gallon of material for the various techniques.

Table 29: Estimated Costs and Coverage of the Various Fill Techniques

Fill Technique	Cost (*$/lf*)	Coverage (*lf/gal.*)
Simple Band-Aid	1.20	102.4
Capped	1.20	102.6
Square and Flush	1.65	34.2
Square and Recessed	1.65	51.3
Square and Band-Aid	1.65	25.6
Shallow and Flush	1.60	30.1

4.3 Material Costs

Eight crack sealants manufactured by three companies were used in this study. Material costs were ascertained directly from local vendors, since the contractor's bids (from MDT bid documents) did not specify their choice of materials or their cost. Cost per pound and unit weight (in pounds per gallon) of all the materials is provided in Table 30. Unit costs are calculated by multiplying the material costs by the unit weight. The average unit cost for all of the materials is $3.17 per gallon. These prices are estimates and may vary depending on where the materials are obtained as well as the quantity purchased. To preserve anonymity, vendor names associated with specific materials are omitted.

Table 30: Material Costs as Provided by Vendors

Material	Material Cost (*$/lb.*)	Unit Weight (*lb./gal.*)	Unit Cost (*$/gal.*)
Crafco Roadsaver 221	0.38	10.0	3.80
Crafco Roadsaver 231	0.34	9.3	3.16
Crafco Polyflex 516	0.36	10.0	3.60
Crafco Roadsaver 522	0.44	9.6	4.22
Maxwell Elastoflex 60	0.26	10.5	2.73
Maxwell Elastoflex 71	0.305	9.4	2.87
Maxwell Elastoflex 72	0.285	10.0	2.85
Deery 101 ELT	0.228	9.5	2.17
		Average Unit Cost	**3.17**

Variations in prices of the crack sealant material were accounted for in the cost-effectiveness analysis by adjusting the bid prices presented in Table 29 for the price differences reported in Table 30. Unfortunately, relative to the prices in Table 29, the contractors did not specify the brand of material or their purchase price in their bids. The cost of materials included in these prices was estimated as the average cost for materials as quoted in Table 30 ($3.17 per gallon). This average cost was subtracted from the average bid price to determine the cost of labor for each technique. Then, the actual prices for individual materials were added to the labor to determine a specific bid price for each material/technique combination. Figure 30 illustrates this process. Using this method, average costs of specific material/technique combinations used at the Helena test site were calculated, and are summarized in Table 31.

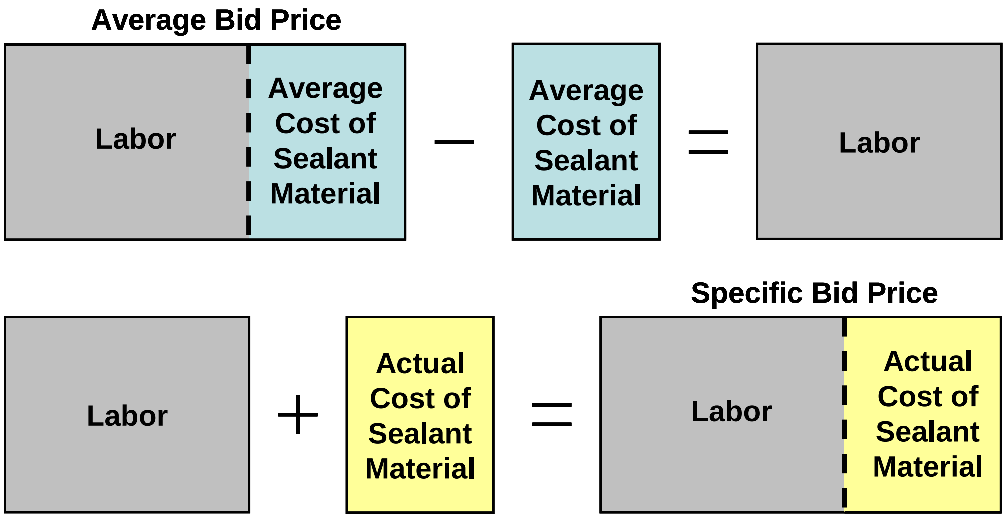

Figure 30: Method of Determining Individual Bid Prices for All Material/Technique Combinations

Table 31: Total Cost of Installing Specific Material/Technique Combinations for the Helena Site

Materials	Techniques				
	BA	SQ-F	SQ-R	SQ-BA	SH-F
Crafco 231	$1.21	$1.65	$1.65	$1.65	$1.60
Crafco 522	$1.22	$1.69	$1.68	$1.70	$1.64
Maxwell 71	$1.20	$1.65	$1.65	$1.64	$1.59
Maxwell 72	$1.20	$1.65	$1.65	$1.64	$1.59
Deery 101 ELT	$1.20	$1.63	$1.64	$1.62	$1.57

Installation costs are reported per linear foot of crack

4.4 Cost-Effectiveness Analysis

A cost-effectiveness analysis was conducted to determine which of the crack sealing materials and techniques was most cost-effective assuming that they will eventually enhance pavement performance. In this analysis the effectiveness was defined as the area under the crack sealant's performance curve. The performance curve was generated by plotting the condition of the crack sealant with respect to time. Two methods were employed to estimate crack sealing performance: Method A and Method B. The simplest method (Method A) used the forecasted life of a particular material/technique combination to estimate performance. For this method, a triangular area is formed, assuming that crack sealant performance decays linearly over time, as illustrated in Figure 31. Even though crack sealant does not typically decay linearly, this assumption provides a reasonable estimate of relative cost-effectiveness, and is less complicated to compute.

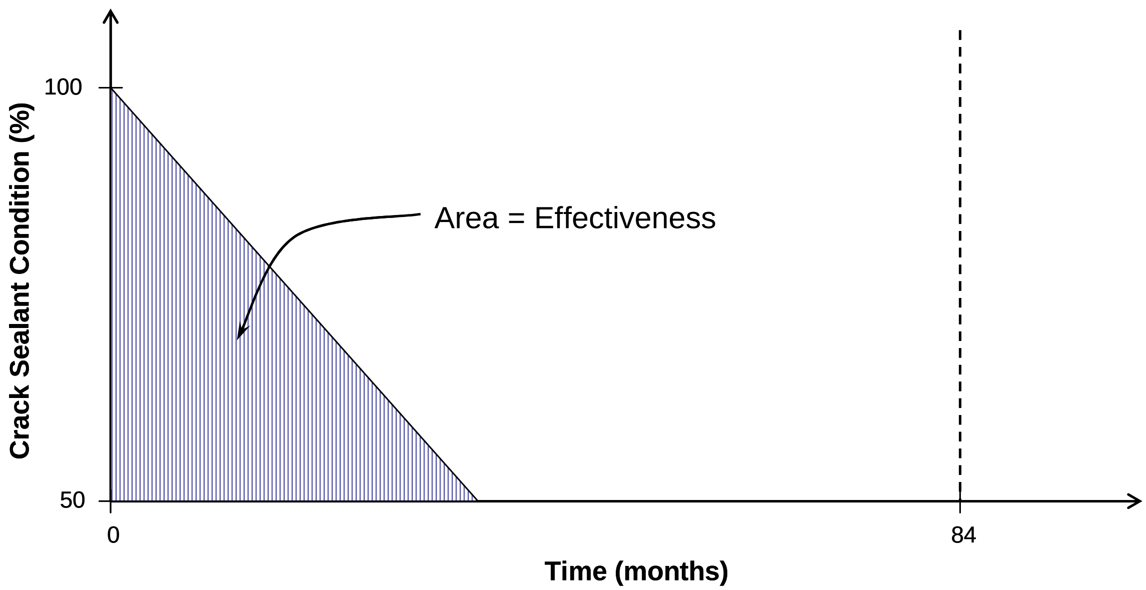

Figure 31: Example of Assumed Crack Sealant Performance Curve (Method A)

The minimum acceptable level of service of crack sealing (condition = 50 percent) is defined by the water's ability to penetrate 50 percent of the sealed crack's length. Field measurements conducted as part of this study were used to determine, and in some cases estimate, the time at which various crack sealant material/techniques combinations would reach this condition. Evaluations at the Helena site were conducted for 57 months, so for those material/technique combinations that did not realize 50 percent failure during the evaluation period, statistical forecasting was used to estimate useful life (as described in Section 3.4.4). A summary of these life expectancies is provided in Table 32.

Table 32: Measured and Estimated Life Expectancy of the Helena Material/Technique Combinations

Materials	Techniques				
	BA	SQ-F	SQ-R	SQ-BA	SH-F
Crafco 231	45	103	79	103	139
Crafco 522	67	175	79	163	151
Maxwell 71	32	103	32	57	103
Maxwell 72	32	91	32	32	127
Deery 101 ELT	6	32	32	32	32

Life expectancies are reported in months (from Table 21)

For combinations that were forecast to last longer than the assumed 84 month (7-year) rehabilitation cycle, the effectiveness is defined as the area that comprises the polygon from time zero to 84 months, as illustrated in Figure 32. This analysis was conducted only on materials and techniques used at the Helena site, since reliable and consistent data was lacking from the other three sites (as described earlier).

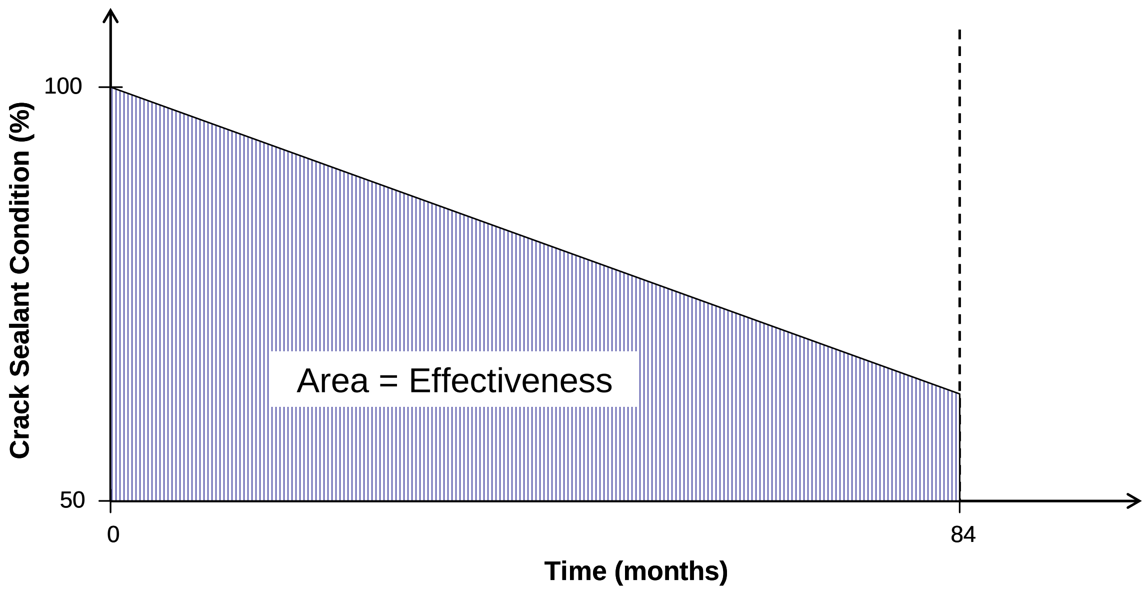

Figure 32: Example of Performance Curve for Crack Sealant Lasting Greater Than 84 Months

Method B was created because the exponential portion of the forecasting technique used to estimate useful life of crack sealing was sensitive to fluctuations in the distress data. As such, this method used measured performance conditions collected from the Helena test site at specific time intervals. An example of the performance over time is illustrated in Figure 33. The effectiveness of crack sealing was only determined for the 57 month period during which data were collected. As in Method A, Method B defines the minimum acceptable level of service of crack sealing to be when its condition = 50 percent, i.e., when water is able to penetrate 50 percent of the sealed crack's length. Only areas formed above this line are considered in the effectiveness calculation. This method provides a more accurate estimate of the effectiveness of crack sealing material/technique combinations since it considers real performance values over time rather than an estimated performance derived from estimates of useful life.

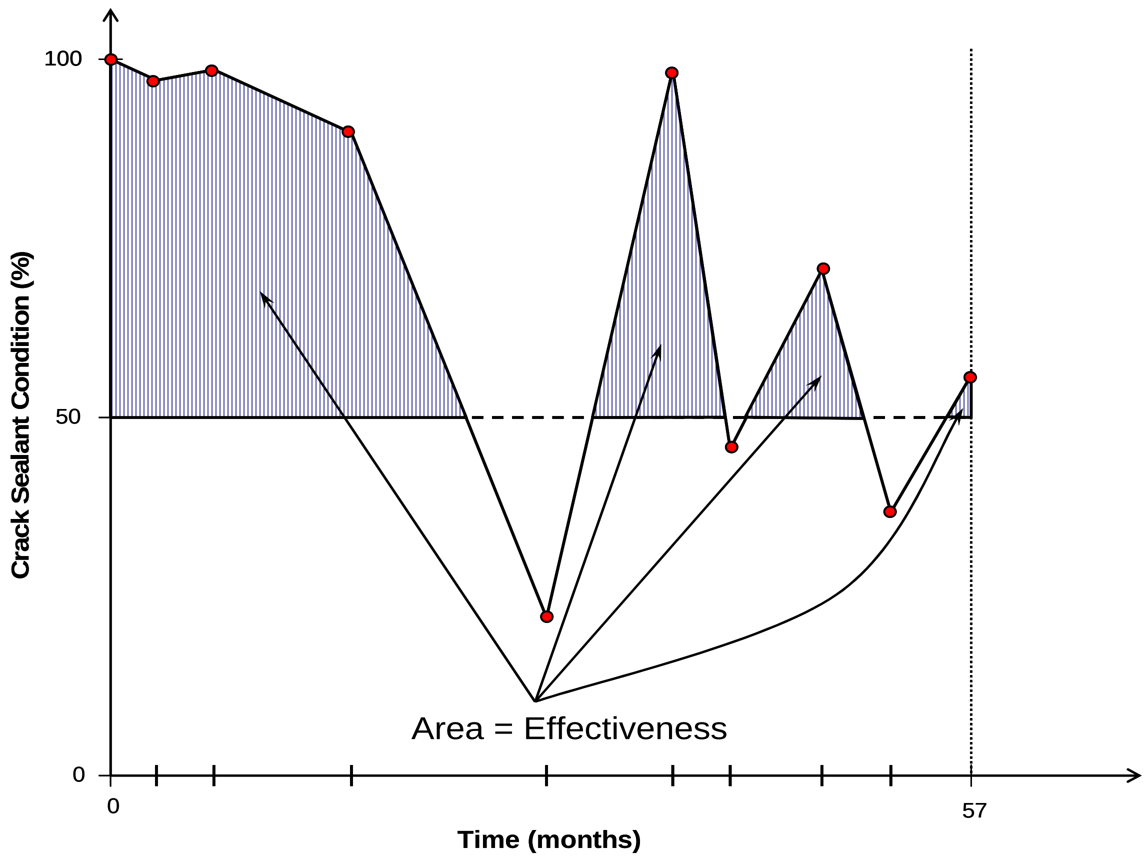

Figure 33: Example of Actual Crack Sealant Performance Curve (Method B)

The effectiveness of the 25 material/technique combinations was determined using both methodologies. The effectiveness was divided by the average installation cost (Table 31) to determine cost-effectiveness. The results of this analysis are shown in Tables 33 and 34 for Methods A and B, respectively. Larger values indicate higher cost-effectiveness, while lower values indicate lower cost-effectiveness. Values in Table 33 should not be directly compared to values in Table 34.

Table 33: Cost-Effectiveness Values of the Helena Material/Technique Combinations using Method A

Materials	Techniques					*Material Averages*
	BA	SQ-F	SQ-R	SQ-BA	SH-F	
Crafco 231	932	1,772	1,012	1,504	1,828	1,410
Crafco 522	1,376	1,894	1,179	1,839	1,850	1,627
Maxwell 71	664	1,511	485	867	1,561	1,018
Maxwell 72	664	1,375	485	487	1,765	955
Deery 101 ELT	125	492	489	495	510	422
Technique Averages	752	1,409	730	1,038	1,503	

Table 34: Cost-Effectiveness Values of the Helena Material/Technique Combinations using Method B

Materials	Techniques					*Material Averages*
	BA	SQ-F	SQ-R	SQ-BA	SH-F	
Crafco 231	3,443	3,107	2,829	3,316	3,284	3,196
Crafco 522	4,144	3,109	2,790	3,219	3,302	3,313
Maxwell 71	1,800	3,075	1,733	2,818	3,409	2,567
Maxwell 72	1,773	3,187	1,745	2,438	3,415	2,512
Deery 101 ELT	1,680	1,555	1,206	1,768	2,748	1,791
Technique Averages	2,568	2,807	2,061	2,712	3,232	

Overall, the averaged results from either method show that the Crafco 522 sealant material and the Shallow and Flush technique were the most cost-effective. Closely following was Crafco 231 and the Square and Flush technique. The least cost-effective material and technique were Deery 101 ELT and Square and Recessed, respectively. Nevertheless, the ranking of the cost-effectiveness of specific material/technique combinations were not the same between the two methods. The top ten individual rankings of specific material/technique combinations are shown in Table 35.

Table 35: Individual Rankings of Specific Material/Technique Combinations Based on Their Cost-Effectiveness

Rank	Material/Technique Combination	
	Method A	Method B
1	Crafco 522, SQ-F	Crafco 522, BA
2	Crafco 522, SH-F	Crafco 231, BA
3	Crafco 522, SQ-BA	Maxwell 72, SH-F
4	Crafco 231, SH-F	Maxwell 71, SH-F
5	Crafco 231, SQ-F	Crafco 231, SQ-BA
6	Maxwell 72, SH-F	Crafco 522, SH-F
7	Maxwell 71, SH-F	Crafco 231, SH-F
8	Maxwell 71, SQ-F	Crafco 522, SQ-BA
9	Crafco 231, SQ-BA	Maxwell 72, SQ-F
10	Crafco 522, BA	Crafco 522, SQ-F

In conclusion, the cost-effectiveness of various material/technique combinations was determined related to their ability to prevent water from infiltrating into the pavement structure. Based on structural and ride data from the Helena site, it cannot be said whether or not crack sealing provides added benefit or reduces deterioration over time, since no differences in performance were detected between the sealed and the unsealed test sections. As such, it is not known whether sealing cracks is necessary to maintain pavement integrity. Therefore, this analysis only distinguishes which material/technique combination will most cost-effectively prevent moisture intrusion, assuming that it will positively improve or maintain pavement performance. With more research, it may be determined that water must be prevented from entering into the pavement for a specific time interval, or not at all. In the case that crack sealing is necessary, specific material/technique combinations that provide the required effectiveness at the lowest cost should be used. Notably, the crack sealing approach that has the highest cost-effectiveness as calculated herein (defined as the ratio of effectiveness to cost) may not offer the best value, if this effectiveness is in excess of that required to protect the pavement from premature damage. More research is needed to definitively determine how long crack sealing should last for it to help the pavement maintain a predetermined level of performance.

5 CONCLUSIONS

After monitoring performance of crack sealing materials and techniques for Conrad (five years) and Dutton (four years) sites, the following conclusions can be drawn.

1. No substantial differences have been observed between all materials with cone penetration values (ASTM D 5329) greater than 90. All these sealants seem to remain flexible at cold temperatures. The only materials studied that do not belong to this group and that have offered inferior performance are Crafco 221 (Conrad) and Crafco 516 (Dutton).
2. Routing transverse cracks, rather than leaving the cracks unrouted, improved the performance of sealants. Band-Aid and Capped configurations generally suffered cohesion failures, most likely due to the large thermal movements. Among the routed techniques, however, the square reservoirs with recessed sealant did not perform well. They appeared to be susceptible to adhesion failures.
3. During the initial three years of performance monitoring, routing did not appear to be necessary for longitudinal cracks. Simple Band-Aid and Capped configurations both performed well. After the fifth year evaluation, this was no longer true. Significant failures were seen in both unrouted configurations with all of the evaluated materials at the Conrad test location. Dependant on weather conditions, three to four years should be the expected service life for Simple Band-Aid and Capped sealed longitudinal cracks.
4. Acceptable sealant performance cannot be met if installation methods are not adequate.

Even though the Tarkio site did not have many cracks, a few conclusions can be drawn from this site.

1. Overall the level of stone intrusion at Tarkio was low, however, this site had the highest occurrence of stone intrusion as a superficial distress. Small pebbles from the chip seal became embedded in the surface of the crack sealant.
2. Tarkio also experienced the highest growth of longitudinal cracks over the evaluation period.
3. The Square Reservoir and Band-Aid technique worked very well. Also performing well was the Shallow Reservoir and Flush technique.
4. The Simple Band-Aid technique worked well for sealing longitudinal cracks.

Based on the data collected at the Helena test site, a number of observations seem warranted.

1. Construction workers operating the routers tended to prefer the shallow reservoir configuration, rather than the square reservoir configuration. When cutting the

shallow reservoirs, the routers were easier to handle and the cracks easier to follow.

2. Higher failure rates can be expected during the coldest months of the year when cracks are widest.
3. Summer heat and the closing of cracks due to the expansion of a pavement will tend to "heal" sealed pavements. However, this healing occurs in Montana after what is typically the wettest period of the year. Consequently, any benefits related to the healing are reduced, as a significant amount of water will have the opportunity to enter the pavement prior to healing.
4. An investigation into alternatives to the current sealant specifications may be warranted. While four materials (Crafco 522, Deery 101, and Maxwell 71 and 72) utilized at the Helena test location all passed current state specifications, Crafco 522 and Crafco 231 appear to continue to offer acceptable performance. This is despite Crafco 231's failure of current test specifications. It is thought that perhaps a testing program, similar to that used to establish the performance grade of an asphalt binder developed as part of the Superpave system, be considered. It is believed that the failures identified in some of the sealants may be reduced or eliminated if a more complete spectrum of tests were implemented over a wider temperature range. Another possibility may be to implement a warranty or performance based specification for future installations.
5. Secondary cracking appears to be influenced by crack geometry. Specifically, the more straight a crack is, the less likely secondary cracking seems to occur.
6. An eclectic forecasting model has proven useful in predicting the life of crack sealing operations. Although, because only a few winter data points were taken, the exponential portion of the eclectic model was very sensitive to large seasonal fluctuations. Therefore, it was necessary to remove the final data point (collected 57 months past installation) to make the analysis more stable. Based on the forecasting analysis, Crafco 522 provides the longest forecasted life, followed by Crafco 231, Maxwell 71, Maxwell 72, and Deery 101, respectively. Additionally, the Shallow and Flush technique provides the longest forecasted life, followed by the Square and Flush, Square and Band-Aid, Square and Recessed, and Simple Band-Aid techniques, respectively.

Structural and pavement roughness monitoring of the Helena site has revealed the following conclusions.

1. All test sections, including sealed and unsealed remain in good structural condition. This result is prudent since the area receives little precipitation, is built on good sub-grade soils and excellent base materials and has little overall traffic.

2. Findings so far support the premise that none of the pavement sections with sealed cracks is deteriorating structurally at a faster rate than the other sealed test sections. Any differences between test sections are most likely a reflection of slight changes in pavement structure along the experimental route.
3. Similarly, structural evaluations did not prove the benefit of sealing cracks in asphalt pavements at all (i.e., sealing versus leaving the cracks unsealed).
4. Testing at similar temperatures would reduce variability in FWD results. Another possibility is to test for longer durations to decipher between temperature effects and the deterioration-related structural changes.
5. Overall, structural evaluations did not prove an advantage for any particular sealing technique or sealing material nor did they prove the benefit of sealing cracks in asphalt pavements.
6. Pavement roughness data from MDT showed that IRI for the sealed and unsealed test sections did not show significant differences.

The cost-effectiveness analysis conducted using data from the Helena test site revealed the following conclusions.

1. Overall, the averaged results from Methods A and B showed that the Crafco 522 sealant material and the Shallow and Flush technique were most cost-effective. Closely following was Crafco 231 and the Square and Flush technique. The least cost-effective material and technique were Deery 101 ELT and the Square and Recessed, respectively.
2. Individual rankings of specific material/technique combinations were different between Method A and Method B. This is because Method A used the forecasted life and assumed a linear decay of crack sealing until the useful life was expended. Method B, on the other hand, utilized actual data collected from the Helena test site, which included seasonal fluctuations in the effectiveness calculation. All in all, Method B yielded more accurate results since it used measured performance of the cracks over time rather than an estimated decay of crack performance.
3. This analysis only distinguishes which materials and techniques (or combinations) will most cost-effectively prevent moisture intrusion, assuming that it will positively improve or maintain pavement performance. More research is needed to determine whether or not water must be prevented from entering into the pavement in the first place.
4. More research is also needed to definitively determine how long and during what time period crack sealing should survive to maintain an acceptable level of pavement performance.

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Appendix A

Weather Data

For the weather data provided for each of the sites, the following table describes the symbols used throughout the remainder of Appendix A. Summary data is shown for each of the years that a particular crack sealing site has been investigated.

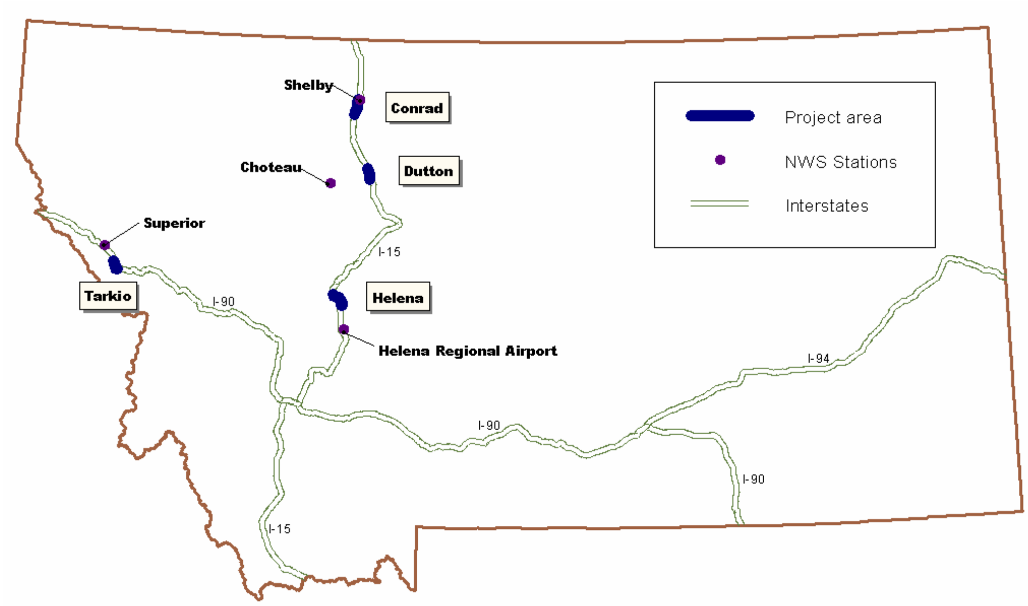
(blank)	Not reported.
+	Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence. Used through December 1983 only.
A	Accumulated amount. This value is a total that may include data from a previous month or months or year (for annual value).
B	Adjusted Total. Monthly value totals based on proportional available data across the entire month.
E	An estimated monthly or annual total.
X	Monthly means or totals based on incomplete time series. 1 to 9 days are missing. Annual means or totals include one or more months which had 1 to 9 days that were missing.
M	Used to indicate data element missing.
T	Trace of precipitation, snowfall, or snowdepth. The precipitation data value will = zero.
Elem->	Element Types are included to provide cross-reference for users of the NCDC CDO System.
Station	Station is identified by: CoopID/WBAN, Station Name, State.
S	Precipitation amount is continuing to be accumulated. Total will be included in a subsequent monthly or yearly value. Example: Days 1-20 had 1.35 inches of precipitation, then a period of accumulation began. The element TPCP would then be 00135S and the total accumulated amount value appears in a subsequent monthly value. If TPCP = "M" there was no precipitation measured during the month. Flag is set to "S" and the total accumulated amount appears in a subsequent monthly value.

Other acronyms used within this appendix are listed below:

- MMXT: Monthly mean maximum temperature
- MMNT: Monthly mean minimum temperature
- MNTM: Monthly mean temperature.
- DPNT: Departure from normal monthly temperature.
- HTDD: Monthly heating degree days - base 65 deg. F. (July 1950 onward.)
- CLDD: Monthly cooling degree days - base 65 deg. F. (1980 onward.)
- EMXT: Extreme maximum temperature for the month. (Contains the day of occurrence in the DAY field.)
- EMNT: Extreme minimum temperature for the month. (Contains the day of occurrence in the DAY field.)
- DT90: Number days with maximum temperature greater than or equal to 90 deg. F.
- DX32: Number days with maximum temperature less than or equal to 32 deg. F.
- DT32: Number days with minimum temperature less than or equal to 32 deg. F.
- DT00: Number days with minimum temperature less than or equal to 0 deg. F.
- TPCP: Total monthly precipitation.
- DPNP: Departure from normal monthly precipitation.
- EMXP: Extreme maximum daily precipitation in the month. (Contains the day of occurrence in the DAY field.)
- TSNW: Total monthly snowfall.
- MXSD: Maximum snow depth during the month. (Contains the day of occurrence in the DAY field.)
- DP01: Number days with greater than or equal to 0.1 inch precipitation. (1954 onward.)
- DP05 Number days with greater than or equal to 0.5 inch precipitation. (1951 onward.)
- DP10 Number days with greater than or equal to 1.0 inch precipitation.

Resource information for this appendix can be found at the following website: *http://lwf.ncdc.noaa.gov/servlets/ACS*. Data is provided from the NCDC CDO System.

Additional documentation can be found at *http://www5.ncdc.noaa.gov/cdo/3220doc.txt*. The map below shows each of the evaluation sites and the corresponding locations of the weather data collection sites.



Conrad site (1996)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(1996)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1996 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	19.2	-4.6X	7.3X		1,802B	0B	55	13	-37	30	0	20	28	20	1.15		0.40	3	16.2			5	0	0
2	37.3	11.3	24.3		1,176	0	59	13	-37	2	0	9	24	9	0.47		0.21	26	0.0X			2	0	0
3	35.6	13.3	24.5		1,249	0	62	14	-27	6	0	14	30	7	0.80		0.18	23	27.6			4	0	0
4	M	M	M		M	M	M		M		M	M	M	M	M		M		M			M	M	M
5	58.5	37.7	48.1		517	0	70	13	24	5	0	0	9	0	2.90X		1.30	17	0.0X			5	2	1
6	75.8	48.6	62.2		112	35	93	7	41	2	2	0	0	0	2.94		1.49	22	0.0			5	2	1
7	84.3	52.1	68.2		16	125	94	16	44	6	6	0	0	0	0.80		0.60	30	0.0			2	1	0
8	86.2	50.2	68.2		28	134	97	11	39	19	13	0	0	0	0.13		0.08	14	0.0			0	0	0
9	66.8	41.5	54.2		320	0	82	13	26	24	0	0	4	0	2.51		1.86	17	0.0			3	1	1
10	58.0	30.0	44.0		644	0	80	10	9	31	0	0	16	0	0.33		0.21	20	0.0X			2	0	0
11	28.2	9.5	18.9		1,382	0	65	2	-25	21	0	16	30	10	1.24X		0.46	19	15.0X			6	0	0
12	22.2	0.6	11.4		1,658	0	45	31	-36	26	0	15	31	13	1.10X		0.56	29	0.0X			1	1	0
Annual	M	M	M		M	M	M	Aug	M	Feb	M	M	M	M	MX		M	Sep	MX			M	M	M

Conrad site (1997)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(1997)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1997 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	24.7	1.2	13.0		1,610	0	53	30	-43	12	0	16	27	15	0.24		0.11	20	0.0X	2	23	1	0	0
2	41.1	20.0	30.6		959	0	61	24	0	5	0	5	26	1	0.22		0.15	27	0.0X	2	27	1	0	0
3	44.3	18.9	31.6		1,029	0	66	25	-13	14	0	6	27	3	1.04		0.71	12	0.0X	4	12	2	1	0
4	50.0	25.0	37.5		818	0	71	16	4	11	0	6	25	0	0.41X		0.10	9	0.0X	2	10	1	0	0
5	67.8	39.6	53.7		346	5	84	15	25	3	0	0	5	0	2.91		1.31	25	0.0	0		6	2	1
6	74.3	49.9	62.1		101	20	85	26	40	21	0	0	0	0	2.74		0.51	29	0.0	0		10	1	0
7	80.9	52.8	66.9		44	108	90	14	42	3	1	0	0	0	0.21		0.12	1	0.0	0		1	0	0
8	84.0	51.2	67.6		43	133	96	23	38	10	10	0	0	0	0.41		0.14	16	0.0	0		2	0	0
9	77.3	43.4	60.4		152	19	89	3	28	19	0	0	3	0	0.28		0.16	14	0.0	0		1	0	0
10	59.0	33.1	46.1		583	3	79	16	12	13	0	0	15	0	0.27		0.18	18	0.0	0		1	0	0
11	40.3	17.4	28.9		1,076	0	65	6	-5	15	0	8	27	4	0.49		0.25	7	0.0X	4	8	2	0	0
12	39.9	18.4	29.2		1,105	0	57	14	-1	19	0	5	26	2	0.16X		0.15	18	2.9X	3	19	1	0	0
Annual	57.0	30.9	44.0		7866	288	96	Aug	-43	Jan	11	46	181	25	9.38X		1.31	May	2.9X	4	Nov	29	4	1

Conrad site (1998)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(1998)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1998 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	29.6	3.3	16.5		1,501	0	56	29	-33	12	0	12	31	14	0.31		0.11	21	0.0X	1	10	1	0	0
2	45.4	17.5	31.5		935	0	57	20	4	28	0	2	28	0	0.13		0.13	25	0.0X	2	25	1	0	0
3	42.7	18.2	30.5		1,066	0	62	31	1	11	0	8	30	0	0.76		0.20	22	0.0X	2	10	4	0	0
4	60.7	32.8	46.8		542	0	81	29	23	9	0	0	16	0	0.69		0.43	5	0.0X	0		2	0	0
5	72.2	40.8	56.5		261	5	86	26	29	2	0	0	2	0	0.58		0.29	14	0.0	0		1	0	0
6	70.6	46.4	58.5		193	4	80	23	31	3	0	0	1	0	2.25		0.51	26	0.0	0		8	1	0
7	86.4	57.0	71.7		1	215	99	17	50	15	10	0	0	0	2.37		1.02	5	0.0	0		5	2	1
8	87.2	53.1	70.2		5	172	97	6	43	25	12	0	0	0	0.49		0.40	1	0.0	0		1	0	0
9	78.4	46.1	62.3		136	57	96	2	30	21	5	0	2	0	0.30		0.11	17	0.0	0		1	0	0
10	61.3	30.2	45.8		588	0	79	7	15	30	0	0	21	0	0.28X		0.28	10	0.0X	M		1	0	0
11	41.4	23.8	32.6		964	0	60	26	2	12	0	6	24	0	0.74		0.36	9	0.0X	2	9	3	0	0
12	33.2	11.6	22.4		1,315	0	58	13	-24	20	0	12	28	10	0.29		0.12	26	0.0X	0		1	0	0
Annual	59.1	31.7	45.4		7507	453	99	Jul	-33	Jan	27	40	183	24	9.19X		1.02	Jul	0.0X	M	Nov	29	3	1

Conrad site (1999)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

ANNUAL CLIMATOLOGICAL SUMMARY

(1999)

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)										
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1999 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	36.8	11.5X	24.2X		1,260B	0B	52	14	-16	24	0	10	29	6	0.25X		0.11	6	7.0X	4	7	1	0	0
2	45.8	21.6	33.7		869	0	57	25	3	11	0	1	28	0	0.30		0.13	10	2.5	2	11	2	0	0
3	51.0	21.0	36.0		891	0	74	25	8	8	0	3	31	0	0.20		0.13	16	0.0X	0		1	0	0
4	56.1	27.6	41.9		686	0	74	18	11	2	0	1	24	0	2.18		0.67	29	0.0	0		5	3	0
5	64.3	37.8	51.1		426	2	87	24	28	11	0	0	7	0	0.85		0.30	10	0.0	0		3	0	0
6	72.2	46.7	59.5		176	16	86	18	35	10	0	0	0	0	2.81		1.09	2	0.0	0		3	2	1
7	81.3	49.0	65.2		94	108	98	28	38	17	6	0	0	0	0.34		0.20	18	0.0	0		1	0	0
8	83.1	53.4	68.3		12	118	97	30	44	17	6	0	0	0	1.15		0.46	12	0.0	0		5	0	0
9	69.2X	38.3	53.8X		333B	2B	86	22	23	28	0	0	5	0	0.56		0.27	26	0.0	0		2	0	0
10	59.2X	31.8	45.5X		590B	0B	77	24	16	1	0	0	18	0	0.62		0.30	26	0.0	0		2	0	0
11	51.7	22.9	37.3		825	0	73	15	-4	28	0	3	25	1	0.51		0.40	26	0.0X	6	26	2	0	0
12	44.6X	21.8	33.2X		981B	0B	65	28	10	9	0	1	30	0	0.15		0.10	20	0.0X	0		1	0	0
Annual	59.6X	32.0X	45.8X		7143	246	98	Jul	-16	Jan	12	19	197	7	9.92X		1.09	Jun	9.5X	6	Nov	28	5	1

Conrad site (2000)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(2000)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2000 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	33.8	5.2X	19.5X		1,407B	0B	45	8	-9	25	0	12	30	14	0.41		0.12	27	6.0X	0		2	0	0
2	37.5	13.3X	25.4X		1,129B	0B	57	7	-14	17	0	9	26	4	0.47		0.25	14	9.7	5	14	1	0	0
3	47.5	24.0X	35.8X		888B	0B	67	27	10	15	0	2	28	0	0.54		0.28	29	0.0X	0		2	0	0
4	61.0	30.5	45.8		570	0	73	22	11	14	0	1	17	0	0.48		0.33	13	0.0X	3	13	2	0	0
5	68.2	39.0	53.6		349	2	83	1	26	14	0	0	9	0	1.24		1.01	31	0.0	0		2	1	1
6	73.6	43.3	58.5		198	10	88	30	30	10	0	0	1	0	1.88		0.63	8	0.0	0		5	1	0
7	87.4	50.9	69.2		22	161	99	29	40	12	14	0	0	0	0.29		0.09	9	0.0	0		0	0	0
8	84.4	48.4	66.4		49	99	98	9	39	29	8	0	0	0	0.07		0.04	7	0.0	0		0	0	0
9	70.8	40.8	55.8		284	18	94	16	18	23	2	0	7	0	0.84		0.30	18	0.0	0		4	0	0
10	57.6	26.5	42.1		706	0	77	8	7	5	0	0	23	0	0.47		0.27	12	0.0	0		2	0	0
11	40.1	11.8	26.0		1,162	0	61	4	-8	12	0	6	28	4	0.19X		0.19	29	0.0X	0		1	0	0
12	26.6	1.2	13.9		1,579	0	54	6	-26	12	0	17	30	15	0.74		0.29	22	0.0X	4	22	3	0	0
Annual	57.4	27.9X	42.7X		8343	290	99	Jul	-26	Dec	24	47	199	37	7.62X		1.01	May	15.7X	5	Feb	24	2	1

Conrad site (2001)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

ANNUAL CLIMATOLOGICAL SUMMARY

(2001)

Station: **247500/99999, SHELBY, Montana** Elev. 3324 ft. above sea level Lat. 48°30'N, Lon. 111°51'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2001 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	39.4	12.9	26.2		1197	0	56	5	-6	16	0	8	28	3	0.31		0.22	13	6.2	4	16	1	0	0
2	27.4	4.8	16.1		1364	0	51	28	-14	27	0	18	27	13	0.37		0.12	24	0.0X	0		2	0	0
3	49.1	23.7	36.4		880	0	65	8	10	23	0	2	27	0	0.27		0.11	13	1.0	0T	14	1	0	0
4	54.9	30.1	42.5		670	0	79	27	18	22	0	0	19	0	1.20		0.44	2	0.0	0		5	0	0
5	71.4	40.4	55.9		290	16	91	24	25	3	1	0	6	0	0.34		0.19	28	0.0	0		2	0	0
6	76.1	44.8	60.5		162	33	91	21	35	3	1	0	0	0	1.53		0.57	18	0.0	0		5	1	0
7	80.9	53.0	67.0		39	107	97	5	46	26	4	0	0	0	4.00		0.90	31	0.0	0		11	4	0
8	89.4	50.9	70.2		15	182	100	3	41	10	18	0	0	0	0.00		0.00	31	0.0	0		0	0	0
9	77.7	42.3X	60.0X		169B	25B	90	24	34	30	1	0	0	0	0.27X		0.21	7	0.0	0		1	0	0
10	59.4	29.5	44.5		630	0	84	2	16	15	0	0	20	0	0.23		0.17	11	0.0	0		1	0	0
11	49.2	24.6	36.9		836	0	67	13	-1	30	0	6	19	2	0.52		M		0.0X	4	24	0	0	0
12	35.7	9.1	22.4		1313	0	46	25	-4	31	0	7	31	5	0.01		0.01	3	0.0T	3	1	0	0	0
Annual	59.2	30.5X	44.9X		7565	363	100	Aug	-14	Feb	25	41	177	23	9.05X		M	Jul	7.2X	4	Nov	29	5	0

Dutton site (1996)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(1996)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **241737/99999, CHOTEAU, Montana** Elev. 3844 ft. above sea level Lat. 47°49'N, Lon. 112°12'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1996 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	25.8	1.3	13.6	-9.0	1,595	0	53	13	-34	30	0	16	28	17	0.79X	M	0.17	3	7.9X	4	31	5	0	0
2	41.6	15.4	28.5	0.1	1,054	0	62	16	-32	2	0	8	22	8	0.59	0.39	0.31	25	3.5	4	3	3	0	0
3	38.0	13.8	25.9	-7.9	1,207	0	65	14	-30	6	0	12	28	8	1.05	0.67	0.20	22	14.9	6	6	6	0	0
4	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
5	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
6	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
7	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
8	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
9	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
10	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
11	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
12	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
Annual	M	M	M	M	M	M	M	Mar	M	Jan	M	M	M	M	M	M	M	Feb	M	M	Mar	M	M	M

Dutton site (1997)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(1997)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **241737/99999, CHOTEAU, Montana** Elev. 3844 ft. above sea level Lat. 47°49'N, Lon. 112°12'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1997 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	M	M	M	M	M	M					M	M	M	M	M	M			M			M	M	M
2	M	M	M	M	M	M					M	M	M	M	M	M			M			M	M	M
3	M	M	M	M	M	M					M	M	M	M	M	M			M			M	M	M
4	50.6	25.0	37.8	-5.7	808	0					0	6	22	1	0.71	-0.09			8.7			4	0	0
5	67.8	37.0	52.4	-0.4	386	1					0	0	7	0	3.51	1.52			0.0X			9	1	1
6	73.6	45.9	59.8	-1.4	154	6					0	0	0	0	3.98	1.80			0.0			9	3	1
7	79.5	46.7	63.1	-4.1	78	27					0	0	0	0	2.11	0.80			0.0			3	2	1
8	81.3	46.2	63.8	-2.2	84	53					4	0	0	0	1.66	0.36			0.0			5	1	0
9	75.7	38.1	56.9	0.6	242	5					0	0	6	0	0.75	-0.27			0.0			3	0	0
10	58.5	31.4	45.0	-3.1	610	0					0	0	19	0	0.47	0.05			0.5			3	0	0
11	46.0	20.9	33.5	-0.3	938	0					0	4	27	1	0.37	0.05			2.0			2	0	0
12	43.3	18.2	30.8	5.9	1,057	0					0	3	30	0	0.00T	-0.36			0.0T			0	0	0
Annual	M	M	M	M	M	M					M	M	M	M	M	M			MX			M	M	M

Dutton site (1998)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(1998)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **241737/99999, CHOTEAU, Montana** Elev. 3844 ft. above sea level Lat. 47°49'N, Lon. 112°12'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1998 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	33.4	6.4	19.9	-2.7	1,393	0	58	1	-30	12	0	9	28	10	0.57	0.28	0.30	2	10.8	6	4	2	0	0
2	47.2	17.2	32.2	3.8	912	0	58	19	2	26	0	0	28	0	0.16	-0.04	0.10	25	2.2	2	25	1	0	0
3	44.9	18.7	31.8	-2.0	1,020	0	63	24	-8	7	0	6	30	1	0.31	-0.07	0.08	29	8.0	5	4	0	0	0
4	59.2	30.9	45.1	1.6	591	0	78	23	20	16	0	0	19	0	0.74	-0.06	0.45	6	0.0X	0		1	0	0
5	69.4	37.3	53.4	0.6	355	0	79	3	27	16	0	0	7	0	1.94	-0.05	0.49	17	0.0	0		5	0	0
6	66.7	43.5	55.1	-6.1	289	0	77	1	31	3	0	0	2	0	4.72	2.54	0.86	12	0.0X	0		12	3	0
7	82.5	52.2	67.4	0.2	21	102	93	17	43	13	3	0	0	0	1.02	-0.29	0.31	3	0.0	0		4	0	0
8	83.8	48.9	66.4	0.4	35	83	93	6	37	25	3	0	0	0	0.64	-0.66	0.38	8	0.0	0		2	0	0
9	77.4	44.0	60.7	4.4	165	41	92	7	28	22	5	0	2	0	0.33	-0.69	0.29	25	0.0	0		1	0	0
10	59.9	30.1	45.0	-3.1	612	0	76	7	12	30	0	0	22	0	0.64X	M	0.59	10	0.0X	M		1	1	0
11	42.2	25.9	34.1	0.3	919	0	58	26	2	10	0	4	24	0	0.90	0.58	0.25	28	8.9	5	9	3	0	0
12	34.7	12.6	23.7	-1.2	1,276	0	58	13	-24	20	0	9	27	7	0.32	-0.04	0.20	18	4.8	4	29	1	0	0
Annual	58.4	30.6	44.6	-0.3	7588	226	93	Aug	-30	Jan	11	28	189	18	12.29X	M	0.86	Jun	34.7X	M	Jan	33	4	0

Dutton site (1999)

U.S. Department of Commerce
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ANNUAL CLIMATOLOGICAL SUMMARY

(1999)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **241737/99999, CHOTEAU, Montana** Elev. 3844 ft. above sea level Lat. 47°49'N, Lon. 112°12'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1999 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	39.4	18.5X	29.0X	6.4	1,111B	0B	56	14	-10	24	0	7	26	3	0.16	-0.13	0.09	23	2.5	4	3	0	0	0
2	43.6	23.4	33.5	5.1	876	0	57	24	-4	11	0	3	25	1	0.33	0.13	0.18	9	4.6	4	10	2	0	0
3	51.2	22.2	36.7	2.9	870	0	71	25	13	8	0	2	28	0	0.36	-0.02	0.36	31	5.3	5	31	1	0	0
4	53.5	27.3	40.4	-3.1	730	0	74	18	2	2	0	3	23	0	1.08	0.28	0.45	28	2.7X	5	1	3	0	0
5	63.4	34.6	49.0	-3.8	487	0	83	25	22	8	0	0	12	0	1.27	-0.72	0.66	30	0.0X	0		4	1	0
6	69.4	42.6	56.0	-5.2	261	0	82	18	29	10	0	0	1	0	2.59	0.41	0.66	3	0.0	0		7	2	0
7	79.5	44.0	61.8	-5.4	141	49	94	28	28	16	4	0	1	0	0.35	-0.96	0.11	21	0.0	0		2	0	0
8	80.4	49.7	65.1	-0.9	40	50	91	30	42	23	1	0	0	0	1.73	0.43	0.65	12	0.0	0		5	1	0
9	67.0	35.8	51.4	-4.9	401	0	81	23	21	28	0	0	7	0	1.40	0.38	0.77	3	0.0X	0		3	1	0
10	60.0	31.7	45.9	-2.2	584	0	75	23	14	16	0	1	17	0	1.00	0.58	0.86	27	0.0X	0T	2	1	1	0
11	54.2	28.2	41.2	7.4	708	0	75	8	5	27	0	1	18	0	0.71	0.39	0.58	26	6.0	6	27	1	1	0
12	46.0	25.0	35.5	10.6	907	0	65	27	3	20	0	0	27	0	0.06	-0.30	0.05	21	1.2	1	21	0	0	0
Annual	59.0	31.9X	45.5X	0.6	7116	99	94	Jul	-10	Jan	5	17	185	4	11.04	0.47	0.86	Oct	22.3X	6	Nov	29	7	0

Dutton site (2000)

U.S. Department of Commerce
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ANNUAL CLIMATOLOGICAL SUMMARY

(2000)

National Climatic Data Center
Federal Building
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Asheville, North Carolina 28801

Station: **241737/99999, CHOTEAU, Montana** Elev. 3844 ft. above sea level Lat. 47°49'N, Lon. 112°12'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2000 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	36.6	12.3	24.5	1.9	1,249	0	47	4	-7	3	0	9	30	2	0.39	0.10	0.12	11	6.4X	2	29	1	0	0
2	39.6	15.6	27.6	-0.8	1,080	0	56	8	-10	17	0	7	28	6	0.56	0.36	0.20	15	6.2	5	17	2	0	0
3	49.8	25.7	37.8	4.0	837	0	67	27	15	15	0	2	28	0	0.27	-0.11	0.09	28	0.8X	1	8	0	0	0
4	60.9	29.0	45.0	1.5	594	0	73	30	10	14	0	1	21	0	0.24	-0.56	0.12	2	1.2	1	14	1	0	0
5	66.3	38.1	52.2	-0.6	391	0	80	1	23	8	0	0	6	0	2.07	0.08	1.68	31	3.0	3	31	2	1	1
6	71.0	43.0	57.0	-4.2	237	2	86	30	31	2	0	0	1	0	1.58	-0.60	0.43	15	0.0	0		5	0	0
7	84.8	47.8	66.3	-0.9	49	96	96	29	34	5	8	0	0	0	0.51	-0.80	0.17	19	0.0	0		3	0	0
8	83.5	46.2X	64.9X	-1.1	69B	71B	94	9	35	29	5	0	0	0	0.11	-1.19	0.06	12	0.0	0		0	0	0
9	68.8	39.3	54.1	-2.2	336	16	90	15	15	23	1	1	9	0	0.68	-0.34	0.23	21	2.7	3	22	3	0	0
10	58.1	28.5	43.3	-4.8	666	0	75	9	11	7	0	0	21	0	0.94	0.52	0.55	12	0.7	1	4	2	1	0
11	36.5	14.1X	25.3X	-8.5	1,185B	0B	60	4	-19	11	0	11	28	5	0.63	0.31	0.24	9	10.3	5	13	3	0	0
12	30.9	7.7	19.3	-5.6	1,410	0	55	6	-21	12	0	14	30	10	0.18	-0.18	0.08	9	7.3	6	16	0	0	0
Annual	57.2	28.9X	43.1X	-1.8	8103	185	96	Jul	-21	Dec	14	45	202	23	8.16	-2.41	1.68	May	38.6X	6	Dec	22	2	1

Tarkio site (1998)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(1998)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **248043/24159, SUPERIOR, Montana** Elev. 2709 ft. above sea level Lat. 47°12'N, Lon. 114°53'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1998 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	35.8	22.8X	29.3X	2.6	1,092B	0B	52	2	-11	12	0	6	30	2	2.06X	M	0.74	2	0.1X	8	13	7	1	0
2	44.5	24.9	34.7	1.7	840	0	53	20	16	18	0	0	25	0	0.82	-0.22	0.21	23	4.5	0		4	0	0
3	51.8	27.8	39.8	0.7	775	0	65	15	11	19	0	0	25	0	1.74	0.40	0.43	17	1.0	0		6	0	0
4	62.7	30.4	46.6	0.1	545	0	81	30	16	18	0	0	19	0	0.99	-0.17	0.19	24	0.0X	0		6	0	0
5	72.1	38.8	55.5	1.5	290	0	86	2	27	15	0	0	8	0	5.33	3.64	1.69	22	0.0	0		9	3	2
6	72.9	39.3	56.1	-5.5	260	2	89	30	20	17	0	0	5	0	2.46	0.69	0.45	7	0.0	0		9	0	0
7	90.2	54.8	72.5	5.0	3	243	100	27	40	2	17	0	0	0	2.87	2.01	0.86	29	0.0	0		5	3	0
8	90.5	51.1	70.8	3.8	9	194	103	6	42	19	20	0	0	0	1.42	0.06	0.94	1	0.0	0		2	1	0
9	84.2	47.0	65.6	7.8	92	120	100	6	36	22	9	0	0	0	0.72	-0.44	0.20	20	0.0	0		4	0	0
10	61.3	32.8	47.1	0.1	548	0	77	1	21	30	0	0	15	0	0.35	-0.83	0.25	2	0.0	M		1	0	0
11	44.8	32.6	38.7	3.2	781	0	55	26	22	9	0	0	13	0	3.18	1.61	0.47	21	0.0	0		13	0	0
12	34.3	22.3	28.3	1.1	1,131	0	46	17	-13	21	0	7	25	5	3.32	1.63	0.61	26	0.0X	0		9	2	0
Annual	62.1	35.4X	48.8X	1.8	6366	559	103	Aug	-13	Dec	46	13	165	7	25.26X	M	1.69	May	5.6X	M	Jan	75	10	2

Tarkio site (1999)

U.S. Department of Commerce
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ANNUAL CLIMATOLOGICAL SUMMARY

(1999)

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151 Patton Avenue
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Station: **248043/24159, SUPERIOR, Montana** Elev. 2709 ft. above sea level Lat. 47°12'N, Lon. 114°53'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1999 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	39.2	25.4X	32.3X	5.6	1,006B	0B	51	29	4	25	0	3	25	0	1.10X	M	0.20	24	M	12	23	5	0	0
2	43.2	23.6X	33.4X	0.4	878B	0B	49	28	8	10	0	1	25	0	2.40X	M	0.65	7	8.6	0		5	2	0
3	55.0	26.2X	40.6X	1.5	751B	0B	71	21	13	4	0	0	28	0	1.44	0.10	0.29	29	0.0T	0T	11	6	0	0
4	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
5	68.1	37.5X	52.8X	-1.2	379B	7B	92	25	24	8	2	0	6	0	0.70	-0.99	0.23	18	0.0	0		3	0	0
6	74.7	44.2	59.5	-2.1	192	30	90	16	31	8	2	0	3	0	2.07	0.30	0.75	17	0.0	0		7	1	0
7	86.3	46.7X	66.5X	-1.0	61B	116B	101	29	33	3	16	0	0	0	0.59	-0.27	0.27	22	0.0	0		2	0	0
8	88.9	53.5X	71.2X	4.2	16B	219B	98	3	45	31	20	0	0	0	0.93	-0.43	0.30	11	0.0	0		4	0	0
9	77.2	36.1X	56.7X	-1.1	245B	5B	88	23	29	28	0	0	6	0	0.37	-0.79	M		0.0X	0		1	0	0
10	62.8X	32.4X	47.6X	0.6	533B	0B	78	5	22	16	0	0	19	0	1.39	0.21	0.49	9	0.0	0		4	0	0
11	49.4	30.3X	39.9X	4.4	748B	0B	74	12	14	21	0	0	16	0	2.20	0.63	0.87	26	0.0	0		5	2	0
12	38.0	26.1X	32.1X	4.9	1,015B	0B	50	16	9	28	0	6	24	0	0.78	-0.91	0.35	18	0.0X	0		2	0	0
Annual	MX	MX	MX	M	M	M	M	Jul	M	Jan	M	M	M	M	M	M	M	Nov	MX	M	Jan	M	M	M

Tarkio site (2000)

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Station: **248043/24159, SUPERIOR, Montana** Elev. 2709 ft. above sea level Lat. 47°12'N, Lon. 114°53'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2000 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	35.8	21.0X	28.4X	1.7	1,128B	0B	43	9	1	19	0	4	29	0	2.75X	M	0.80	12	M	5	21	9	2	0
2	43.4	20.1X	31.8X	-1.2	959B	0B	51	22	8	20	0	0	25	0	2.17	1.13	0.70	2	0.0X	7	15	6	1	0
3	54.4	28.0X	41.2X	2.1	720B	0B	73	27	17	8	0	0	19	0	0.28	-1.06	0.10	19	0.0	0		1	0	0
4	66.5	34.6	50.6	4.1	428	0	81	28	26	8	0	0	13	0	0.82	-0.34	0.25	6	0.0	0		4	0	0
5	69.9	39.6X	54.8X	0.8	317B	0B	79	2	29	13	0	0	4	0	1.08	-0.61	0.26	30	0.0	0		5	0	0
6	78.1	46.4X	62.3X	0.7	107B	26B	91	30	36	11	1	0	0	0	0.42	-1.35	0.15	1	0.0	0		2	0	0
7	88.9	50.6X	69.8X	2.3	28B	187B	102	31	39	5	17	0	0	0	0.58	-0.28	M		0.0	0		1	0	0
8	89.6	48.5X	69.1X	2.1	32B	165B	101	10	39	29	18	0	0	0	0.20	-1.16	0.20	11	0.0	0		1	0	0
9	73.1	41.9X	57.5X	-0.3	242B	23B	89	16	24	23	0	0	6	0	1.84	0.68	M		0.0	0		5	0	0
10	58.7	34.8X	46.8X	-0.2	555B	0B	72	10	25	23	0	0	11	0	1.80	0.62	1.10	1	0.0	0		4	1	1
11	36.3	22.3X	29.3X	-6.2	1,065B	0B	47	4	9	14	0	11	27	0	0.31X	M	0.16	5	3.0X	0		1	0	0
12	31.2	18.7	25.0	-2.2	1,233	0	39	27	3	21	0	16	31	0	3.25X	M	M		30.2X	12	15	4	2	0
Annual	60.5	33.9X	47.2X	0.3	6814	401	102	Jul	1	Jan	36	31	165	0	15.50X	M	M	Oct	MX	12	Dec	43	6	1

Tarkio site (2001)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(2001)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **248043/24159, SUPERIOR, Montana** Elev. 2709 ft. above sea level Lat. 47°12'N, Lon. 114°53'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2001 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	35.3	22.4	28.9	2.2	1111	0	49	5	10	8	0	7	31	0	1.12X	M	0.40	25	2.4X	6	12	4	0	0
2	37.8	20.9	29.4	-3.6	993	0	46	24	7	9	0	5	27	0	1.51X	M	0.50	24	3.3X	4	1	4	1	0
3	54.0	29.1	41.6	2.5	720	0	69	24	14	1	0	0	20	0	0.40X	M	0.21	25	0.0	0		2	0	0
4	57.1	33.4X	45.3X	-1.2	581B	0B	81	28	24	5	0	0	14	0	1.51X	M	0.40	9	0.0X	1	2	5	0	0
5	75.1	40.6	57.9	3.9	253	38	96	25	28	3	5	0	4	0	1.12	-0.57	0.42	28	0.0	0		4	0	0
6	76.6	45.8	61.2	-0.4	158	50	93	22	35	5	5	0	0	0	4.84	3.07	1.58	4	0.0	0		12	3	1
7	85.6	52.0	68.8	1.3	32	157	100	5	46	20	12	0	0	0	1.89	1.03	0.50	12	0.0	0		6	1	0
8	92.9	50.5	71.7	4.7	3	217	101	18	40	25	22	0	0	0	0.12	-1.24	0.12	5	0.0	0		1	0	0
9	83.4	42.6	63.0	5.2	90	37	95	25	31	21	4	0	2	0	0.35	-0.81	0.15	7	0.0	0		1	0	0
10	59.6	35.9X	47.8X	0.8	514B	0B	87	2	26	7	0	0	8	0	2.92X	M	0.50	17	0.0	0		9	1	0
11	46.3	30.4X	38.4X	2.9	790B	0B	57	14	20	28	0	0	19	0	0.85	-0.72	0.24	22	0.0	0		4	0	0
12	34.4	25.5X	30.0X	2.8	1078B	0B	44	16	16	28	0	11	25	0	1.10X	M	0.30	14	3.0X	0		5	0	0
Annual	61.5	35.8X	48.7X	1.8	6323	499	101	Aug	7	Feb	48	23	150	0	17.73X	M	1.58	Jun	8.7X	6	Jan	57	6	1

Helena site (1998)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(1998)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1998 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	32.7	9.7	21.2	1.6	1,353	0	58	1	-29	12	0	9	31	8	0.49	-0.14	0.29	19				1	0	0
2	42.2	19.8	31.0	4.6	942	0	53	21	11	28	0	0	28	0	0.12	-0.29	0.08	21				0	0	0
3	44.3	21.3	32.8	-0.8	990	0	59	31	-3	7	0	7	27	2	0.39	-0.34	0.31	3				1	0	0
4	58.1	31.4	44.8	1.4	600	0	80	23	22	18	0	0	18	0	0.64	-0.33	0.16	7				3	0	0
5	68.5	39.2	53.9	1.4	336	0	80	29	30	19	0	0	4	0	2.27	0.49	0.55	26				6	1	0
6	66.2	43.9	55.1	-7.0	293	0	81	30	31	4	0	0	1	0	3.03	1.16	0.99	19				8	1	0
7	85.5	54.0	69.8	0.6	2	161	97	17	48	9	10	0	0	0	2.96	1.86	1.23	28				4	2	1
8	86.6	50.5	68.6	1.2	8	124	95	5	42	27	13	0	0	0	0.50	-0.79	0.24	23				2	0	0
9	78.4	45.4	61.9	6.5	158	72	96	7	30	21	8	0	3	0	0.82	-0.33	0.59	9				1	1	0
10	58.4	29.1	43.8	-1.3	650	0	77	7	15	30	0	0	18	0	0.14	-0.46	0.07	15				0	0	0
11	43.3	25.7	34.5	2.9	909	0	64	26	8	9	0	3	24	0	1.07	0.59	0.39	22				5	0	0
12	34.1	14.8	24.5	3.3	1,249	0	58	17	-23	21	0	12	30	6	0.14	-0.45	0.05	4				0	0	0
Annual	58.2	32.1	45.2	1.2	7490	357	97	Jul	-29	Jan	31	31	184	16	12.57	0.97	1.23	Jul				31	5	1

Helena site (1999)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(1999)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
1999 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	39.6X	16.1	27.9X	8.3	1,142B	0B	55	14	-10	25	0	6	29	3	0.38	-0.25	0.12	23	M	M		2	0	0
2	41.9	22.8	32.4	6.0	905	0	58	24	6	12	0	2	27	0	0.26	-0.15	0.08	9	M	M		0	0	0
3	51.6	22.5	37.1	3.5	859	0	74	25	11	6	0	1	31	0	0.02	-0.71	0.02	1	M	M		0	0	0
4	54.5	27.1	40.8	-2.6	718	0	74	18	12	15	0	0	22	0	1.05	0.08	0.51	27	M	M		3	1	0
5	63.1	37.3	50.2	-2.3	451	0	86	25	27	6	0	0	6	0	2.19	0.41	0.75	30	M	M		5	2	0
6	71.6	46.0	58.8	-3.3	188	10	86	24	30	10	0	0	1	0	2.15	0.28	0.56	3	M	M		8	1	0
7	83.6	46.9	65.3	-3.9	79	93	100	28	39	16	11	0	0	0	0.41	-0.69	0.15	1	M	M		1	0	0
8	84.6	52.1	68.4	1.0	20	132	96	30	41	31	8	0	0	0	1.92	0.63	0.90	11	M	M		5	1	0
9	68.9	36.9	52.9	-2.5	354	0	84	23	23	28	0	0	6	0	0.54	-0.61	0.29	2	M	M		2	0	0
10	60.4	31.1	45.8	0.7	590	0	75	13	18	16	0	0	19	0	0.39	-0.21	0.30	27	0.0T	0T	26	1	0	0
11	52.2	26.2	39.2	7.6	767	0	75	12	14	23	0	0	24	0	0.13	-0.35	0.07	25	M	M		0	0	0
12	40.3	18.9	29.6	8.4	1,088	0	51	12	5	28	0	2	28	0	0.10	-0.49	0.02	21	0.5X	1	21	0	0	0
Annual	59.4X	32.0	45.7X	1.7	7161	235	100	Jul	-10	Jan	19	11	193	3	9.54	-2.06	0.90	Aug	MX	M	Dec	27	5	0

Helena site (2000)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(2000)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2000 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	34.8	15.2	25.0	5.4	1,232	0	52	16	-5	3	0	12	31	4	0.26	-0.37	0.11	11	3.9	2	16	1	0	0
2	40.6	17.0	28.8	2.4	1,043	0	59	8	1	18	0	7	27	0	0.32	-0.09	0.10	15	5.7X	4	15	1	0	0
3	49.7	27.5	38.6	5.0	814	0	67	27	19	21	0	1	26	0	0.26	-0.47	0.14	8	2.3	0T	8	1	0	0
4	60.9	33.0	47.0	3.6	535	0	75	27	17	14	0	0	15	0	0.73	-0.24	0.24	22	M	M		3	0	0
5	66.1	43.6	54.9	2.4	308	2	82	1	33	31	0	0	0	0	0.98	-0.80	0.38	30	M	M		3	0	0
6	76.0	48.8	62.4	0.3	119	50	96	7	33	1	4	0	0	0	1.42	-0.45	0.79	15	M	M		4	1	0
7	87.6	56.6	72.1	2.9	16	245	101	30	46	5	13	0	0	0	0.73	-0.37	0.23	3	M	M		4	0	0
8	86.2	53.0	69.6	2.2	13	165	99	1	42	31	11	0	0	0	0.43	-0.86	0.29	4	M	M		1	0	0
9	70.4	42.3	56.4	1.0	279	27	94	15	19	23	2	0	5	0	0.54	-0.61	0.25	1	M	M		2	0	0
10	56.1	33.0	44.6	-0.5	625	0	72	18	19	7	0	0	13	0	2.12	1.52	0.60	12	M	M		5	2	0
11	30.6	13.3	22.0	-9.6	1,283	0	59	4	0	12	0	18	30	1	0.36	-0.12	0.11	8	M	M		1	0	0
12	25.5	6.9	16.2	-5.0	1,505	0	48	27	-18	16	0	21	31	7	0.23	-0.36	0.05	30	M	M		0	0	0
Annual	57.0	32.5	44.8	0.8	7772	489	101	Jul	-18	Dec	30	59	178	12	8.38	-3.22	0.79	Jun	M	M	Feb	26	3	0

Helena site (2001)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(2001)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2001 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	29.2	10.9	20.1	0.5	1385	0	52	5	-9	29	0	21	31	3	0.27	-0.36	0.19	25				1	0	0
2	27.3	8.2	17.8	-8.6	1314	0	43	1	-4	27	0	19	28	11	0.17	-0.24	0.04	15				0	0	0
3	44.8	25.5	35.2	1.6	917	0	58	19	6	1	0	0	26	0	0.44	-0.29	0.17	26				2	0	0
4	55.0	32.9	44.0	0.6	625	0	81	26	22	3	0	1	16	0	1.39	0.42	0.41	2				4	0	0
5	74.5	43.8	59.2	6.7	212	41	93	24	26	3	2	0	2	0	1.23	-0.55	1.08	28				1	1	1
6	77.4	50.7	64.1	2.0	113	94	95	22	39	5	4	0	0	0	2.11	0.24	1.15	3				6	1	1
7	86.5	57.5	72.0	2.8	11	237	98	11	51	31	13	0	0	0	1.94	0.84	0.51	12				7	1	0
8	92.0	57.3	74.7	7.3	0	308	102	3	47	1	23	0	0	0	0.43	-0.86	0.41	4				1	0	0
9	80.2	48.9	64.6	9.2	66	61	96	3	42	20	5	0	0	0	1.38	0.23	0.77	5				2	1	0
10	59.3	37.4	48.4	3.3	511	0	87	1	23	5	0	0	7	0	0.54	-0.06	0.12	28				2	0	0
11	50.6	27.8	39.2	7.6	766	0	68	5	9	28	0	3	21	0	0.13	-0.35	0.13	26				1	0	0
12	33.9	15.7	24.8	3.6	1239	0	49	17	-4	26	0	13	30	3	0.28	-0.31	0.12	21				1	0	0
Annual	59.2	34.7	47.0	3.1	7159	741	102	Aug	-9	Jan	47	57	161	17	10.31	-1.29	1.15	Jun				28	4	2

Helena site (2002)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(2002)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2002 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	37.9	21.2	29.6	9.4	1093	0	61	7	4	29	0	10	29	0	0.04	-0.48	0.04	9				0	0	0
2	42.5	18.0	30.3	3.9	968	0	63	22	-13	26	0	4	26	3	0.29	-0.09	0.21	23				1	0	0
3	35.9	14.4	25.2	-9.9	1229	0	67	31	-12	8	0	12	26	6	0.52	-0.11	0.19	20				3	0	0
4	56.0	30.0	43.0	-1.1	652	0	73	13	3	2	0	1	17	0	0.61	-0.30	0.19	27				2	0	0
5	66.0	40.8	53.4	0.5	366	15	90	20	24	9	1	0	5	0	1.86	0.08	0.96	22				5	1	0
6	75.8	49.8	62.8	1.6	126	71	93	27	36	10	3	0	0	0	4.36	2.54	1.04	10				8	3	1
7	87.5	57.2	72.4	4.6	1	238	105	12	45	2	11	0	0	0	1.61	0.27	0.68	14				5	1	0
8	78.0	49.9	64.0	-2.7	52	29	87	13	38	17	0	0	0	0	1.32	0.03	0.32	7				5	0	0
9	71.9	46.2	59.1	3.0	201	30	92	15	35	23	1	0	0	0	1.22	0.17	0.41	27				4	0	0
10	52.8	28.0	40.4	-4.4	755	0	73	10	-2	31	0	3	20	1	0.16	-0.50	0.11	22				1	0	0
11	43.6	25.5	34.6	3.7	904	0	62	20	1	1	0	7	20	0	0.50	0.02	0.28	23				2	0	0
12	36.1	20.0	28.1	6.7	1138	0	53	15	8	24	0	15	29	0	0.05	-0.41	0.03	3				0	0	0
Annual	57.0	33.4	45.2	1.3	7485	383	105	Jul	-13	Feb	16	52	172	10	12.54	1.22	1.04	Jun				36	5	1

Helena site (2003)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY

(2003)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **244055/24144, HELENA REGIONAL AIRPORT, Montana** Elev. 3827 ft. above sea level Lat. 46°36'N, Lon. 111°58'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2003 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	38.5	20.2	29.4	9.2	1096	0	57	26	1	22	0	7	28	0	0.41	-0.11	0.15	22				1	0	0
2	33.5	17.0	25.3	-1.1	1105	0	46	1	-13	24	0	10	27	3	0.29	-0.09	0.15	8				1	0	0
3	44.8	23.5	34.2	-0.9	951	0	69	13	-7	8	0	6	21	3	0.74	0.11	0.36	7				3	0	0
4	57.2	34.7	46.0	1.9	562	0	74	11	19	3	0	0	11	0	2.27	1.36	0.64	18				8	1	0
5	65.3	41.2	53.3	0.4	389	31	92	28	30	20	2	0	7	0	1.25	-0.53	0.41	3				3	0	0
6	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
7	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
8	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
9	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
10	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
11	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
12	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M					M	M	M
Annual	M	M	M	M	M	M	M	May	M	Feb	M	M	M	M	M	M	M	Apr				M	M	M

Appendix B

Crack Inventory for the Conrad Site

Table B1: Item with Crafco 221, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 354.3 (ft)	Crack Number	Distance from MP 354.3 (ft)	Length (ft)
May 1996	1* †[c]	5	1*	5 to 103	98
	2*	44	2*	168 to 184	16
	3*	77	3*	252 to 384	132
	4*	127	4*	489 to 502	13
	5*	204	5* #	532 to 735	203
	6*	229	6* #	885 to 966	81
	7*	252	7* #	982 to 1057	75
	8*	302			
	9*	342			
	10*	420			
	11*	469			
	12* #	518			
	13* #	623			
	14* #	680			
	15* #	758			
	16* #	833			
	17* #	875			
	18* #	969			
	19* #	1041			
July 1998	None		2+	162 to 168	6
			2+	184 to 190	6
			4+	481 to 489	8
			5+	526 to 532	6
			8	776 to 822	46
			7+	975 to 982	7
May 1999	None		None		
June 2000	None		9	435 to 440	5
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] crack removed by milling in Spring 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1057 ft

Table B2: Item with Crafco 221, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 354.5 (ft)	Crack Number	Distance from MP 354.5 (ft)	Length (ft)
May 1996	1* †	37	1*	0 to 22	22
	2*	103	2*	43 to 92	49
	3*	131	3* #	266 to 871	605
	4*	162	4* #	882 to 1059	177
	5*	216			
	6*	245			
	7*	266			
	8*	323			
	9*	369			
	10*	400			
	11*	424			
	12*	533			
	13*	551			
	14*	643			
	15* #	726			
	16* #	746			
	17* #	801			
	18* #	882			
	19* #	929			
	20* #	957			
	21* #	988			
	22* # †	1028			
July 1998	None		1+2	22 to 43	21
			5	162 to 202	40
			4+	871 to 882	11
May 1999	None		None		
June 2000	None		None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1059 ft

Table B3: Item with Crafco 221, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 354.7 (ft)	Crack Number	Distance from MP 354.7 (ft)	Length (ft)
May 1996	1*	78	1*	0 to 381	381
	2*	149	2*	393 to 569	176
	3*	170	3* #	612 to 698	86
	4*	192	4* #	707 to 735	28
	5*	226	5* #	748 to 837	89
	6*	339	6* #	894 to 986	92
	7*	425	7* #	1006 to 1062	56
	8*	486			
	9*	511			
	10*	562			
	11*	589			
	12*	612			
	13* #	647			
	14* #	668			
	15* #	707			
	16* #	735			
	17* #	794			
	18* #	842			
	19* #	894			
	20* # †	998			
July 1998	None		2+	381 to 393	12
May 1999	None		None		
June 2000	None		3+	699 to 701	2
			8	867 to 875	8
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1062 ft

Table B4: Item with Crafco 221, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 354.9 (ft)	Crack Number	Distance from MP 354.9 (ft)	Length (ft)
May 1996	1*	47	1*	0 to 30	30
	2*	137	2*	100 to 126	26
	3*	211	3*	150 to 211	61
	4*	286	4*	222 to 271	49
	5*	310	5*	286 to 330	44
	6*	339	6*	339 to 421	82
	7* #	380	7*	498 to 518	20
	8* #	421	8*	610 to 656	46
	9* #	466	9* #	684 to 1059	375
	10* #	599			
	11* #	745			
	12* #	839			
	13* #	949			
	14* # †	1019			
July 1998	None		2+3	126 to 150	24
			3+4	211 to 222	11
			4+5	271 to 286	15
			5+6	330 to 339	9
			6+	421 to 466	45
			10	538 to 560	22
			8+	599 to 610	11
			8+	656 to 663	7
May 1999	None		None		
June 2000	15	531	None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1059 ft
Note: Transverse cracks 12, 13, and 14 are evaluated in the travelling lane only. The cracks were not routed in the passing lane.

Table B5: Item with Crafco 221, Capped

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 355.1 (ft)	Crack Number	Distance from MP 355.1 (ft)	Length (ft)
May 1996	1*	15	1* #	0 to 1060	1060
	2*	93			
	3*	134			
	4*	223			
	5*	276			
	6*	350			
	7*	418			
	8*	513			
	9* #	569			
	10* #	672			
	11* #	712			
	12* #	773			
	13* #	851			
	14* #	903			
	15* #	966			
	16* # †	1028			
July 1998	None		None		
May 1999	None		None		
June 2000	None		None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1060 ft

Table B6: Item with Maxwell 60, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 355.4 (ft)	Crack Number	Distance from MP 355.4 (ft)	Length (ft)
May 1996	1*	50	1*	0 to 50	50
	2*	146	2*	56 to 126	70
	3*	208	3*	161 to 233	72
	4*	255	4*	499 to 523	24
	5*	389	5*	539 to 643	104
	6* #	480	6* #	660 to 876	216
	7* #	539	7* #	892 to 939	47
	8* #	651	8* #	963 to 1023	60
	9* #	775	9* #	1035 to 1063	28
	10* #	809			
	11* #	882			
	12* #	939			
	13* # †	1035			
July 1998	None		1+2	50 to 56	6
			2+	126 to 141	15
			3+	233 to 246	13
			4+	492 to 499	7
			8+9	1023 to 1035	12
May 1999	None		None		
June 2000	None		3+	160 to 161	1
			4+	523 to 527	4
			6+	876 to 879	3
			7+	887 to 892	5
			8+	962 to 963	1
			2++	141 to 144	3
			10	344 to 363	19
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1063 ft

Table B7: Item with Maxwell 60, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 355.6 (ft)	Crack Number	Distance from MP 355.6 (ft)	Length (ft)
May 1996	1*	71	1*	0 to 128	128
	2*	171	2*	155 to 164	9
	3*	297	3*	171 to 297	126
	4*	450	4*	328 to 513	185
	5*	519	5*	565 to 580	15
	6* #	589	6* #	589 to 840	251
	7* #	650	7* #	851 to 958	107
	8* #	780	8* #	964 to 1027	63
	9* #	840	9* #	1047 to 1058	11
	10* #	929			
	11* #	964			
	12* #	1027			
	13* # †	1047			
July 1998	None		1+	128 to 138	10
			4+	311 to 328	17
			7+8	958 to 964	6
May 1999	None		None		
June 2000	None		7+	847 to 851	4
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1058 ft

Table B8: Item with Maxwell 60, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 355.8 (ft)	Crack Number	Distance from MP 355.8 (ft)	Length (ft)
May 1996	1*	64	1*	0 to 36	36
	2*	124	2*	54 to 64	10
	3*	209	3*	133 to 165	32
	4*	283	4* #	209 to 1056	847
	5*	415			
	6* #	515			
	7* #	556			
	8* #	576			
	9* #	672			
	10* #	759			
	11* #	798			
	12* #	917			
	13* # †	1052			
July 1998	None		2+	64 to 70	6
May 1999	None		None		
June 2000	None		None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1056 ft

Table B9: Item with Maxwell 60, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 356.0 (ft)	Crack Number	Distance from MP 356.0 (ft)	Length (ft)
May 1996	1*	24	1*	0 to 140	140
	2*	80	2*	313 to 471	158
	3*	165	3*	486 to 510	24
	4*	208	4* #	562 to 731	169
	5*	306	5* #	746 to 859	113
	6	355	6* #	885 to 921	36
	7	486	7* #	947 to 961	14
	8* #	526	8* #	994 to 1067	73
	9* #	562			
	10* #	635			
	11* #	705			
	12* #	740			
	13* #	841			
	14* #	910			
	15* # †	941			
July 1998	None		3+	510 to 516	6
			4+	731 to 740	9
			5+6	859 to 885	26
			6+	921 to 926	5
			7+	941 to 947	6
			7+	961 to 970	9
May 1999	None		None		
June 2000	None		2+	471 to 478	7
			8+	991 to 994	3
			7++	970 to 972	2
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1067 ft
Note: Sealant in the longitudinal reservoir is recessed. Sealant in the passing lane portion of transverse reservoirs is also recessed, but sealant in the traveling lane of transverse reservoirs has been squeegeed flush. Evaluations for transverse cracks are performed in the passing lane only.

Table B10: Item with Maxwell 60, Capped

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 356.2 (ft)	Crack Number	Distance from MP 356.2 (ft)	Length (ft)
May 1996	1*	8	1*	26 to 52	26
	2*	58	2*	134 to 191	57
	3*	134	3*	213 to 233	20
	4*	283	4*	257 to 519	262
	5*	394	5*	528 to 558	30
	6	519	6*	569 to 622	53
	7	634	7*	648 to 662	14
	8	662	8* #	675 to 1142	467
	9* #	770			
	10* #	801			
	11* #	845			
	12* #	873			
	13* #	896			
	14* #	936			
	15* #	986			
	16* # †	1108			
July 1998	None		1+	21 to 26	5
			9	105 to 110	5
			3+	207 to 213	6
			4+	249 to 257	8
May 1999	None		None		
June 2000	None		2+	191 to 193	2
			3+	233 to 238	5
			7+	644 to 648	4
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1142 ft

Table B11: Item with Maxwell 60, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 356.4 (ft)	Crack Number	Distance from MP 356.4 (ft)	Length (ft)
May 1996	1* #	40	1* #	0 to 35	35
	2* #	140	2* #	40 to 201	161
	3* #	190	3* #	225 to 241	16
	4* #	269	4* #	303 to 322	19
	5* #	350			
	6* #	437			
	7* # †	529			
July 1998	8	63	None		
	9	404			
May 1999	None		None		
June 2000	None		1+	35 to 40	5
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 562 ft

Table B12: Item with Deery 1101, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 356.7 (ft)	Crack Number	Distance from MP 356.7 (ft)	Length (ft)
May 1996	1* #	136	1* #	367 to 454	87
	2* #	339	2* #	496 to 530	34
	3* #	492	3* #	797 to 824	27
	4* #	622	4* #	886 to 949	63
	5* #	652	5* #	967 to 989	22
	6* #	694			
	7* #	787			
	8* # †	931			
July 1998	None		6	577 to 587	10
			7	597 to 607	10
			3+	792 to 797	5
			4+	869 to 886	17
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 989 ft

Table B13: Item with Deery 1101, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 356.9 (ft)	Crack Number	Distance from MP 356.9 (ft)	Length (ft)
May 1996	1* #	30	1* #	226 to 258	32
	2* #	215	2* #	333 to 355	22
	3* #	355	3* #	425 to 531	106
	4* #	396	4* #	1027 to 1041	14
	5* #	425	5* #	1051 to 1091	40
	6* #	451			
	7* #	497			
	8* # †	1057			
July 1998	None		4+5	1041 to 1051	10
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1091 ft
Bridge from 544 ft to 1027 ft
Note: Transverse cracks 5 through 8 are evaluated in the travelling lane only. Passing lane portions were filled to flush, without a band-aid.

Table B14: Item with Deery 1101, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 357.1 (ft)	Crack Number	Distance from MP 357.1 (ft)	Length (ft)
May 1996	1*	4	1*	32 to 141	109
	2*	40	2*	180 to 214	34
	3*	141	3*	220 to 256	36
	4* #	220	4*	275 to 337	62
	5* #	262	5*	393 to 471	78
	6* #	383	6*	491 to 564	73
	7* #	564	7*	572 to 610	38
	8* #	795	8*	647 to 1048	401
	9* #	934			
	10* #	993			
	11* # †	1021			
July 1998	12	689	1+	4 to 32	28
			2+3	214 to 220	6
			4+	337 to 343	6
			9	346 to 363	17
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1048 ft
Note: Longitudinal cracks were routed and filled to flush, so they were not evaluated. The passing lane portion of transverse cracks were also routed and filled to flush, so they were not evaluated. The traveling lane portion of transverse cracks were not routed and were provided with a simple band-aid, so they were evaluated.

Table B15: Item with Deery 1101, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 357.3 (ft)	Crack Number	Distance from MP 357.3 (ft)	Length (ft)
May 1996	1* #	66	1*	0 to 66	66
	2* #	211	2*	80 to 204	124
	3* #	312	3*	220 to 440	220
	4* #	440	4* #	456 to 581	125
	5* #	675	5* #	634 to 850	216
	6* #	863	6* #	893 to 903	10
			7* #	966 to 989	23
			8* #	1022 to 1035	13
July 1998	7	561	4+	447 to 456	9
	8	801	6+	890 to 893	3
	9 †	1012	7+	989 to 1003	14
			8+	1012 to 1022	10
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1044 ft

Table B16: Item with Deery 1101, Capped

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 357.5 (ft)	Crack Number	Distance from MP 357.5 (ft)	Length (ft)
May 1996	1* #	481	1* #	86 to 375	289
	2* #	538	2* #	438 to 473	35
	3* #	616	3* #	500 to 1056	556
	4* #	912			
	5* # †	1005			
July 1998	6	188	1+	45 to 86	41
	7	645	3+	496 to 500	4
	8	774			
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1056 ft

Table B17: Item with Deery 1101, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 357.7 (ft)	Crack Number	Distance from MP 357.7 (ft)	Length (ft)
May 1996	1* #	213	1*	24 to 93	69
	2* #	463	2*	109 to 213	104
	3* #	612	3*	236 to 432	196
	4* # †	789	4* #	481 to 590	109
			5* #	655 to 789	134
			6* #	828 to 899	71
			7* #	960 to 1025	65
July 1998	5	87	None		
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1044 ft

Table B18: Item with Crafco 231, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 358.0 (ft)	Crack Number	Distance from MP 358.0 (ft)	Length (ft)
May 1996	1*	33	1*	0 to 350	350
	2*	85	2*	358 to 477	119
	3*	190	3* #	524 to 554	30
	4*	229	4* #	773 to 1064	291
	5*	274			
	6*	305			
	7*	350			
	8*	398			
	9*	425			
	10*	453			
	11*	513			
	12*	561			
	13*	616			
	14* #	666			
	15* #	739			
	16* #	812			
	17* #	856			
	18* #	887			
	19* #	938			
	20* #	973			
	21* # †	1013			
July 1998	22	780	2+	477 to 492	15
			3+	520 to 524	4
May 1999	None		None		
June 2000	None		2+	356 to 358	2
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1064 ft

Table B19: Item with Crafco 231, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 358.2 (ft)	Crack Number	Distance from MP 358.2 (ft)	Length (ft)
May 1996	1*	6	1* #	0 to 1020	1020
	2*	50	2* #	1034 to 1048	14
	3*	80			
	4*	126			
	5*	157			
	6*	181			
	7*	206			
	8*	280			
	9*	302			
	10*	327			
	11*	351			
	12*	396			
	13*	425			
	14*	505			
	15* #	586			
	16* #	655			
	17* #	744			
	18* #	816			
	19* #	899			
	20* #	968			
	21* #	1008			
	22* # †	1026			
July 1998	None		1+2	1020 to 1034	14
May 1999	None		None		
June 2000	23	934	None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1054 ft

Table B20: Item with Crafco 231, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 358.4 (ft)	Crack Number	Distance from MP 358.4 (ft)	Length (ft)
May 1996	1*	10	1*	29 to 224	195
	2*	67	2*	248 to 407	159
	3* #	118	3*	424 to 454	30
	4* #	248	4*	464 to 518	54
	5* #	390	5*	539 to 715	176
	6* #	445	6* #	743 to 1062	319
	7* #	539			
	8* #	687			
	9* #	814			
	10* # †	868			
July 1998	None		1+	24 to 29	5
			1+2	224 to 248	24
			2+3	407 to 424	17
			4+5	518 to 539	18
			6+	728 to 743	15
May 1999	None		None		
June 2000	None		None		
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1062 ft

Table B21: Item with Crafco 231, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 358.6 (ft)	Crack Number	Distance from MP 358.6 (ft)	Length (ft)
May 1996	1*	14	1* #	0 to 334	334
	2*	260	2* #	537 to 567	30
	3* #	342	3* #	577 to 602	25
	4* #	372	4* #	727 to 760	33
	5* #	473	5* #	891 to 922	31
	6* #	634	6* #	947 to 980	33
	7* #	713	7* #	997 to 1024	27
	8* #	786			
	9* #	849			
	10* # †	928			
July 1998	11	71	1+	334 to 342	8
			8	353 to 411	58
			9	430 to 452	22
			2+	490 to 537	47
			2+3	567 to 577	10
			3+	602 to 623	21
			10	641 to 713	72
			4+	760 to 766	6
			11	797 to 836	39
			5+	875 to 891	16
			6+7	980 to 997	17
			7+	1024 to 1041	17
May 1999	None		None		
June 2000	12	462	5+	922 to 923	1
	13	567	6+	945 to 947	2
			8+	351 to 353	2
			9+	420 to 430	10
			2++	488 to 490	2
			3++	623 to 627	4
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1041 ft

Table B22: Item with Crafco 231, Capped

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 358.8 (ft)	Crack Number	Distance from MP 358.8 (ft)	Length (ft)
May 1996	1*	144	1*	104 to 233	129
	2*	276	2*	245 to 276	31
	3* #	363	3*	286 to 340	54
	4* #	441	4*	363 to 612	249
	5* #	491	5* #	671 to 802	131
	6* #	530	6* #	827 to 1073	246
	7* #	644			
	8* #	802			
	9* #	860			
	10* # †	991			
July 1998	11	1	1+	90 to 104	14
	12	55	4+	612 to 644	32
	13	716	5+	644 to 671	27
			6+	808 to 827	19
May 1999	None		None		
June 2000	None		2+	242 to 245	3
			3+	340 to 343	3
			1++	85 to 90	5
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1073 ft

Table B23: Item with Crafco 231, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 359.0 (ft)	Crack Number	Distance from MP 359.0 (ft)	Length (ft)
May 1996	1*	16	1*	0 to 315	315
	2*	137	2*	326 to 552	226
	3*	238	3* #	665 to 868	203
	4*	326	4* #	882 to 1026	144
	5*	408			
	6*	435			
	7*	464			
	8*	485			
	9*	508			
	10* #	581			
	11* #	609			
	12* #	647			
	13* #	715			
	14* #	741			
	15* #	785			
	16* #	878			
	17* # †	1013			
July 1998	None		1+	315 to 326	11
			2+	552 to 564	12
			5	589 to 647	58
			3+	658 to 665	7
			4+	868 to 882	14
May 1999	None		None		
June 2000	18	838	6	1051 to 1056	5
April 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1056 ft

Table B24: Item with Witco CRF-MP, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 359.3 (ft)	Crack Number	Distance from MP 359.3 (ft)	Length (ft)
May 1996	1*	64	1* #	0 to 970	970
	2*	173	2* #	985 to 1053	68
	3*	213			
	4*	280			
	5*	426			
	6* #	528			
	7* #	601			
	8* #	641			
	9* #	704			
	10* #	757			
	11* #	826			
	12* #	973			
	13* # †	1020			
July 1998	14	96	1+2	970 to 985	15
	15	947			
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1053 ft

Table B25: Item with Witco CRF-MP, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 359.5 (ft)	Crack Number	Distance from MP 359.5 (ft)	Length (ft)
May 1996	1*	27	1*	0 to 320	320
	2*	121	2*	361 to 474	113
	3*	159	3*	532 to 606	74
	4*	263	4* #	606 to 768	162
	5*	324	5* #	780 to 1056	276
	6*	407			
	7*	491			
	8*	566			
	9* #	642			
	10* #	698			
	11* #	780			
	12* #	861			
	13* #	895			
	14* #	951			
	15* # †	1019			
	16* #	1035			
July 1998	17	187	2+	355 to 361	6
			3+	503 to 532	29
			4+5	768 to 780	12
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1056 ft
Note: Transverse cracks 9 through 16 were sealed with a simple band-aid (no routing).

Table B26: Item with Witco CRF-MP, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 359.7 (ft)	Crack Number	Distance from MP 359.7 (ft)	Length (ft)
May 1996	1*	47	1*	0 to 156	156
	2*	74	2*	173 to 234	61
	3*	156	3*	259 to 285	26
	4*	234	4*	305 to 327	22
	5*	294	5* #	355 to 949	594
	6*	355	6* #	966 to 1058	92
	7* #	385			
	8* #	441			
	9* #	544			
	10* #	705			
	11* #	776			
	12* #	824			
	13* #	888			
	14* # †	966			
July 1998	None		1+2	156 to 173	17
			2+3	234 to 259	25
			3+4	285 to 305	20
			4+5	327 to 355	28
			5+	949 to 955	6
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1058 ft

Table B27: Item with Witco CRF-MP, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 359.9 (ft)	Crack Number	Distance from MP 359.9 (ft)	Length (ft)
May 1996	1*	30	1*	0 to 523	523
	2*	103	2*	538 to 662	124
	3*	358	3*	918 to 949	31
	4*	385	4*	979 to 1050	71
	5*	430			
	6*	531			
	7*	694			
	8*	816			
	9*	860			
	10* †	964			
July 1998	None		1+	523 to 531	8
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1059 ft
Note: This test section was not evaluated. Longitudinal and transverse cracks were not routed; they were sealed by simple band-aid.

Table B28: Item with Witco CRF-MP, Capped

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 360.1 (ft)	Crack Number	Distance from MP 360.1 (ft)	Length (ft)
May 1996	1*	15	1*	21 to 63	42
	2*	72	2*	102 to 111	9
	3*	129	3*	185 to 248	63
	4*	176	4*	283 to 343	60
	5*	274	5*	366 to 449	83
	6*	319	6*	476 to 540	64
	7*	357	7*	558 to 586	28
	8*	460	8*	594 to 643	49
	9*	549	9* #	663 to 748	85
	10* #	589	10* #	766 to 846	80
	11* #	656	11* #	860 to 948	88
	12* #	758	12* #	956 to 961	5
	13* #	802	13* #	982 to 1006	24
	14* #	854	14* #	1012 to 1049	37
	15* #	886			
	16* #	948			
	17* # †	1012			
July 1998	None		4+	278 to 283	5
			4+	343 to 352	9
			13+	968 to 982	14
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1049 ft

Table B29: Item with Witco CRF-MP, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 360.3 (ft)	Crack Number	Distance from MP 360.3 (ft)	Length (ft)
May 1996	1*	58	1*	0 to 56	56
	2*	151	2*	66 to 190	124
	3*	190	3*	202 to 1027	825
	4*	302	4*	1046 to 1053	7
	5*	362			
	6*	470			
	7*	574			
	8*	684			
	9*	748			
	10*	783			
	11*	824			
	12*	896			
	13* †	1036			
July 1998	14	418	None		
May 1999[c]	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
[c] eliminated from evaluation program in 1999
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1053 ft
Note: This test section was not evaluated. Longitudinal and transverse cracks were not routed; they were sealed by simple band-aid.

Appendix C

Crack Inventory for the Dutton Site

Table C1: Item with Crafco 299, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 316.80 (ft)	Crack Number	Distance from MP 316.80 (ft)
July 1996	1*	34	20*	704
	2* †	63	21* #	739
	3*	85	22* #	755
	4*	128	23*	794
	5*	186	24*	863
	6*	237	25* #	911
	7*	258	26*	938
	8*	293	27* #	981
	9*	318	28*	1019
	10*	349	29* #	1081
	11*	371	30*	1142
	12*	437	31* #	1192
	13*	479	32*	1233
	14*	525	33* #	1276
	15*	569	34* # †	1304
	16*	600	35*	1342
	17*	628	36*	1399
	18*	653	37*	1466
	19*	674	38*	1530
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1570 ft
Note: Only passing lanes are evaluated. Driving lanes are filled with old sealant.

Table C2: Item with Crafco 516, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 316.59 (ft)	Crack Number	Distance from MP 316.59 (ft)
July 1996	1*	4	20*	650
	2*	40	21* #	673
	3*	84	22*	707
	4*	103	23* #	746
	5*	140	24*	800
	6*	161	25* #	842
	7*	197	26*	878
	8*	230	27*	934
	9*	247	28*	962
	10*	275	29* #	992
	11*	340	30*	1024
	12*	368	31* #	1051
	13*	400	32*	1076
	14*	435	33* #	1115
	15*	461	34*	1149
	16*	491	35* #	1176
	17*	543	36*	1229
	18*	571	37* # †	1262
	19*	621		
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1263 ft
Note: Only passing lanes are evaluated. Driving lanes are filled with old sealant.

Table C3: Item with Crafco 522, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 316.38 (ft)	Crack Number	Distance from MP 316.38 (ft)
July 1996	1*	26	13*	390
	2*	43	14* #	435
	3*	69	15*	472
	4*	112	16* #	500
	5* #	128	17*	536
	6*	156	18*	562
	7* #	186	19* #	588
	8* #	204	20*	642
	9*	221	21*	673
	10*	249	22* #	716
	11*	291	23* # †	742
	12*	307	24*	773
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 774 ft

Table C4: Item with Crafco 231, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 315.96 (ft)	Crack Number	Distance from MP 315.96 (ft)
July 1996	1*	33	16*	497
	2*	58	17*	536
	3*	92	18* #	563
	4*	134	19* #	585
	5*	160	20* #	621
	6*	182	21*	664
	7*	207	22*	732
	8*	242	23* #	760
	9*	263	24* #	788
	10*	290	25* #	829
	11*	323	26*	857
	12*	360	27* #	885
	13*	394	28*	927
	14*	426	29* # †	980
	15*	456		
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 998 ft

Table C5: Item with Crafco 516, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 315.96 (ft)	Crack Number	Distance from MP 315.96 (ft)
July 1996	1*	14	7* #	324
	2* #	49	8*	388
	3*	71	9*	507
	4*	186	10* # †	567
	5* #	216	11*	593
	6*	272	12*	642
June 1998	None			
May 1999	None			
June 2000	None			
[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length) # crack is part of the evaluation program † crack has masonry nails installed for movement measurements Length of section = 642 ft				

Table C6: Item with Crafco 299, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 315.75 (ft)	Crack Number	Distance from MP 315.75 (ft)
July 1996	1*	39	10* #	303
	2*	80	11*	332
	3*	133	12* #	386
	4* #	154	13*	437
	5* #	188	14*	480
	6*	209	15* #	513
	7* #	238	16*	540
	8* #	257	17* # †	585
	9*	284	18*	652
June 1998	None			
May 1999	None			
June 2000	None			
[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length) # crack is part of the evaluation program † crack has masonry nails installed for movement measurements Length of section = 657 ft				

Table C7: Item with Crafco 522, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 315.54 (ft)	Crack Number	Distance from MP 315.54 (ft)
July 1996	1* #	24	10*	485
	2* #	68	11* #	541
	3*	106	12*	566
	4*	208	13* #	609
	5* #	234	14*	641
	6* #	263	15*	737
	7*	319	16*	799
	8*	394	17* # †	825
	9* #	449		
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 853 ft

Table C8: Item with Crafco 231, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 315.33 (ft)	Crack Number	Distance from MP 315.33 (ft)
July 1996	1*	18	3*	144
	2*	102	4* # †	220
June 1998	None			
May 1999	None			
June 2000	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 220 ft

Appendix D

Crack Inventory for the Tarkio Site

Table D1: Control Item

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 61.5 (ft)	Crack Number	Distance from MP 61.5 (ft)	Length (ft)
July 1998	1 #	13	1 #	283 to 330	47
	2 #	167	2 #	576 to 608	32
	3 # †	341			
	4 #	427			
	5 #	559			
	6 #	722			
	7 #	798			
	8 #	930			
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1052 ft

Table D2: Item with Crafco 231, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 61.2 (ft)	Crack Number	Distance from MP 61.2 (ft)	Length (ft)
July 1998	1* #	11	1* #	662 to 676	14
	2* #	79			
	3* #	152			
	4* # †	381			
	5* #	505			
	6* #	646			
	7* #	736			
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	652 to 662	10
			1+	676 to 677	1

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1183 ft

Table D3: Item with Crafco 231, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 61.0 (ft)	Crack Number	Distance from MP 61.0 (ft)	Length (ft)
July 1998	1* # †	776	1* #	119 to 148	29
			2* #	260 to 279	19
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	117 to 119	2
			1+	148 to 149	1
			2+	259 to 260	1
			3	350 to 363	13

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 907 ft

Table D4: Item with Crafco 231, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 60.8 (ft)	Crack Number	Distance from MP 60.8 (ft)	Length (ft)
July 1998	1* #	152	1* #	39 to 73	34
	2* # †	412	2* #	118 to 135	17
	3* #	618	3* #	1069 to 1090	21
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		3+	1067 to 1069	2

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1102 ft

Table D5: Item with Crafco 231, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 60.6 (ft)	Crack Number	Distance from MP 60.6 (ft)	Length (ft)
July 1998	None		1* #	514 to 533	19
			2* #	687 to 699	12
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1001 ft

Table D6: Item with Crafco 231, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 60.4 (ft)	Crack Number	Distance from MP 60.4 (ft)	Length (ft)
July 1998	1* # †	369	1* #	480 to 496	16
	2* #	842	2* #	518 to 531	13
			3* #	563 to 609	46
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	496 to 497	1
			3+	609 to 614	5

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1118 ft

Table D7: Item with Crafco 522, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 60.1 (ft)	Crack Number	Distance from MP 60.1 (ft)	Length (ft)
July 1998	1* #	8	1*	125 to 180	55
	2* #	344	2* #	209 to 259	50
	3* # †	547	3* #	410 to 430	20
	4* #	754	4* #	483 to 493	10
			5* #	551 to 583	32
			6* #	609 to 734	125
			7* #	754 to 778	24
			8* #	810 to 832	22
			9* #	870 to 881	11
			10* #	998 to 1037	39
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	124 to 125	1
			2+	208 to 209	1
			11	281 to 288	7
			12	320 to 325	5
			13	509 to 527	18
			3+	430 to 435	5
			5+	549 to 551	2
			6+	607 to 608	1
			8+	832 to 833	1

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1103 ft
Note: A V-shaped squeegee was used to achieve flush for items with Crafco 522.

Table D8: Item with Crafco 522, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 59.9 (ft)	Crack Number	Distance from MP 59.9 (ft)	Length (ft)
July 1998	1*	95	1* #	141 to 156	15
	2 # †	793	2* #	582 to 624	42
	3 #	939	3* #	738 to 748	10
			4* #	865 to 875	10
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	156 to 159	3
			5*‡	279 to 284	5
			2+	581 to 582	1
			2+	624 to 625	1
			6*‡	702 to 709	7
			6+	698 to 702	4
			6+	702 to 704	2
			3+	736 to 738	2
			3+	748 to750	2
			7*‡	755 to 764	9
			7+	752 to 755	3
			7+	764 to 767	3
			4+	875 to 876	1

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
‡ crack is sealed, but apparently missed in the original inventory
+ indicates length increase to the original crack number listed above
Length of section = 1057 ft

Table D9: Item with Crafco 522, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 59.7 (ft)	Crack Number	Distance from MP 59.7 (ft)	Length (ft)
July 1998	1* #	142	1*	81 to 105	24
	2* #	485	2*	247 to 277	30
	3* # †	631	3* #	355 to 449	94
	4* #	857	4* #	469 to 485	16
	5* #	952	5* #	664 to 800	136
			6* #	803 to 850	47
			7* #	873 to 923	50
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	79 to 81	2
			1+	105 to 107	2
			3+	352 to 355	3
			3+	449 to 450	1
			4+	466 to 469	3
			8*‡	954 to 960	6
			8+	960 to 963	3
			9*‡	976 to 985	9
			10	990 to 995	5

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
‡ crack is sealed, but apparently missed in the original inventory
+ indicates length increase to the original crack number listed above
Length of section = 1059 ft
Note: Delaminations were observed along the centerline at 275 ft and 285 ft. Air pressure would lift a thin layer of pavement material (perhaps the chip seal).

Table D10: Item with Crafco 522, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 59.5 (ft)	Crack Number	Distance from MP 59.5 (ft)	Length (ft)
July 1998	1* #	107	1* #	149 to 170	21
	2* #	204	2* #	771 to 881	110
	3* # †	310			
	4* #	615			
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	147 to 149	2
			1+	170 to 176	6
			3*‡	264 to 269	5
			3+	269 to 271	2
			4	320 to 328	8
			5	545 to 554	9
			6*‡	980 to 987	7

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
‡ crack is sealed, but apparently missed in the original inventory
+ indicates length increase to the original crack number listed above
Length of section = 1064 ft

Table D11: Item with Crafco 522, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 59.3 (ft)	Crack Number	Distance from MP 59.3 (ft)	Length (ft)
July 1998	1* # †	819	1*	69 to 86	17
			2*	147 to 224	77
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	68 to 69	1
			3	96 to 103	7
			4	598 to 610	12
			5	624 to 634	10
			6	689 to 694	5
			7	866 to 876	10
			8	940 to 955	15
			9	1049 to 1057	8

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 1058 ft
Note: A V-shaped squeegee was used to achieve flush for items with Crafco 522.

Table D12: Item with Maxwell 72, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 59.0 (ft)	Crack Number	Distance from MP 59.0 (ft)	Length (ft)
July 1998	1* #	526	1* #	22 to 47	25
	2* # †	624	2* #	535 to 591	56
	3* #	943	3* #	607 to 624	17
			4* #	793 to 844	51
			5* #	962 to 998	36
			6* #	1005 to 1051	46
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	19 to 22	3
			7*‡	111 to 120	9
			2+	532 535	3
			2+	591 to 603	12
			3+	601 to 607	6
			8*‡	744 to 753	9
			9*‡	904 to 913	9
			10*‡	951 to 959	8
			6+	1003 to 1005	2

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
‡ crack is sealed, but apparently missed in the original inventory
+ indicates length increase to the original crack number listed above
Length of section = 1052 ft

Table D13: Item with Maxwell 72, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 58.8 (ft)	Crack Number	Distance from MP 58.8 (ft)	Length (ft)
July 1998	1* #	56	1*	0 to 123	123
	2* # †	223	2*	143 to 159	16
			3*	314 to 327	13
			4*	334 to 459	125
			5* #	474 to 508	34
			6* #	531 to 643	112
			7* #	653 to 827	174
			8*	857 to 870	13
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		1+	123 to 133	10
			2+	140 to 143	3
			2+	159 to 160	1
			3+	311 to 314	3
			3+	327 to 335	8
			4+	459 to 474	15
			5+	508 to 524	16
			6+	529 to 531	2
			6+	643 to 644	1

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
+ indicates length increase to the original crack number listed above
Length of section = 943 ft, ending at a bridge
Longitudinal crack No. 8 was slightly damp during the installation of crack sealant. It was located at the bottom of a hill, just before a bridge.

Table D14: Item with Maxwell 72, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 58.6 (ft)	Crack Number	Distance from MP 58.6 (ft)	Length (ft)
July 1998	None		None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 348 ft, starting after a bridge

Table D15: Item with Maxwell 72, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 58.4 (ft)	Crack Number	Distance from MP 58.4 (ft)	Length (ft)
July 1998	None		None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft

Table D16: Item with Maxwell 72, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 58.2 (ft)	Crack Number	Distance from MP 58.2 (ft)	Length (ft)
July 1998	None		None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft

Table D17: Item with Crafco 221, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 57.9 (ft)	Crack Number	Distance from MP 57.9 (ft)	Length (ft)
July 1998	None		None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft

Table D18: Item with Crafco 221, Square Reservoir and Recess

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 57.7 (ft)	Crack Number	Distance from MP 57.7 (ft)	Length (ft)
July 1998	1* # †	530	None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 935 ft, ending at a bridge

Table D19: Item with Crafco 221, Simple Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 57.5 (ft)	Crack Number	Distance from MP 57.5 (ft)	Length (ft)
July 1998	1* #	587	None		
	2* # †	744			
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 866 ft, starting after a bridge

Table D20: Item with Crafco 221, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 57.3 (ft)	Crack Number	Distance from MP 57.3 (ft)	Length (ft)
July 1998	1* # †	481	None		
	2* #	783			
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft

Table D21: Item with Crafco 221, Square Reservoir and Flush

Full-Width Transverse Cracks[a]			Longitudinal Centerline Cracks[b]		
Date of Inspection	Crack Number	Distance from MP 57.1 (ft)	Crack Number	Distance from MP 57.1 (ft)	Length (ft)
July 1998	None		None		
Aug. 1999	None		None		
Sept. 2000	None		None		
July 2001	None		None		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
[b] each crack is at least 5 ft long (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft

Appendix E

Crack Inventory for the Helena Site

Table E1: Item with Deery CMC 101 ELT, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 215.8 (ft)	Crack Number	Distance from MP 215.8 (ft)
Oct. 1998	1*	72	10* #	688
	2*	105	11* #	716
	3*	164	12* #	768
	4*	212	13* #	828
	5*	286	14* #	874
	6* # †	405	15* #	922
	7* #	485	16* #	966
	8* #	565	17* #	1027
	9* #	640		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April. 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E2: Item with Deery CMC 101 ELT, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 215.6 (ft)	Crack Number	Distance from MP 215.6 (ft)
Oct. 1998	1*	15	10* #	555
	2*	73	11* # †	635
	3*	135	12* #	711
	4*	217	13* #	775
	5*	301	14* #	905
	6* #	358	15* #	934
	7* #	408	16* #	973
	8* #	462	17* #	1018
	9* #	504		
Feb. 1999	None			
July 1999	None			
Aug. 2000	18	847		
April 2001	Longitudinal	973 to 1018		
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1064 ft

Table E3: Item with Deery CMC 101 ELT, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 215.4 (ft)	Crack Number	Distance from MP 215.4 (ft)
Oct. 1998	1* #	4	8* #	583
	2* #	46	9* # †	633
	3* #	150	10* #	707
	4* #	232	11* #	838
	5* #	355	12* #	891
	6* #	413	13* #	996
	7*	488	14*	1053
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	15	271		
	16	319		
	17	538		
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	18**	89		
	19**	192		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1060 ft
** crack propagated only ½ th of the transverse section of the road

Table E4: Item with Deery CMC 101 ELT, Square Reservoir and Recess

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 215.2 (ft)	Crack Number	Distance from MP 215.2 (ft)
Oct. 1998	1*	50	11* #	616
	2*	117	12* # †	690
	3*	167	13*	729
	4*	257	14* #	770
	5*	296	15* #	811
	6*	353	16* #	861
	7*	416	17* #	900
	8* #	473	18* #	928
	9* #	522	19* #	970
	10* #	580	20* #	996
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	21	662		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1058 ft

Table E5: Item with Deery CMC 101 ELT, Simple Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 215.0 (ft)	Crack Number	Distance from MP 215.0 (ft)
Oct. 1998	1*	17	12* #	435
	2*	73	13* #	500
	3*	105	14* #	534
	4*	133	15* #	578
	5*	168	16* # †	621
	6*	192	17* #	665
	7*	225	18* #	737
	8*	269	19* #	787
	9*	297	20* #	836
	10*	335	21* #	931
	11* #	389	22* #	1001
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	23	360		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E6: Item with Crafco Roadsaver 231, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 214.6 (ft)	Crack Number	Distance from MP 214.6 (ft)
Oct. 1998	1*	34	11* #	562
	2*	76	12* #	644
	3*	150	13* #	703
	4*	184	14* # †	766
	5*	241	15* #	837
	6*	313	16* #	858
	7* #	377	17* #	904
	8* #	414	18* #	970
	9*	471	19* #	1040
	10* #	510		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1060 ft

Table E7: Item with Crafco Roadsaver 231, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 214.4 (ft)	Crack Number	Distance from MP 214.4 (ft)
Oct. 1998	1*	34	10* #	540
	2*	55	11* #	598
	3*	136	12* #	654
	4*	213	13* #	706
	5*	284	14* #	785
	6*	348	15* # †	833
	7* #	381	16* #	925
	8* #	416	17* #	971
	9* #	477	18* #	1052
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	19**	890		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1061 ft
** crack propagated only ½ of the transverse section of the road

Table E8: Item with Crafco Roadsaver 231, Simple Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 214.2 (ft)	Crack Number	Distance from MP 214.2 (ft)
Oct. 1998	1*	80	10* #	616
	2*	128	11* # †	719
	3*	198	12* #	764
	4*	279	13* #	817
	5* #	341	14* #	894
	6* #	379	15* #	937
	7* #	438	16* #	1008
	8*	513	17* #	1054
	9* #	556		
Feb. 1999	None			
July 1999	None			
Aug. 2000	18	682		
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1063 ft

Table E9: Item with Crafco Roadsaver 231, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 214.0 (ft)	Crack Number	Distance from MP 214.0 (ft)
Oct. 1998	1*	41	11* #	625
	2*	76	12* # †	674
	3*	116	13* #	708
	4*	195	14* #	754
	5*	236	15* #	803
	6*	312	16* #	855
	7*	390	17* #	883
	8* #	459	18* #	949
	9* #	483	19* #	1014
	10* #	565		
Feb. 1999	None			
July 1999	None			
Aug. 2000	20	533		
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E10: Item with Crafco Roadsaver 231, Square Reservoir and Recess

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 213.8 (ft)	Crack Number	Distance from MP 213.8 (ft)
Oct. 1998	1*	20	13* #	549
	2*	88	14* # †	586
	3*	125	15*	648
	4*	154	16* #	681
	5*	206	17* #	720
	6*	244	18* #	771
	7*	295	19* #	858
	8*	336	20* #	894
	9*	384	21* #	933
	10*	409	22* #	985
	11* #	430	23* #	1048
	12* #	487		
Feb. 1999	None			
July 1999	None			
Aug. 2000	24	806		
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E11: Item with Maxwell Elastoflex 72, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 213.4 (ft)	Crack Number	Distance from MP 213.4 (ft)
Oct. 1998	1*	19	11* #	528
	2*	99	12* #	591
	3*	174	13* #	650
	4*	209	14* #	709
	5*	231	15* #	784
	6*	293	16* #	855
	7*	333	17* #	907
	8* #	387	18* #	949
	9* #	449	19* #	1007
	10* # †	487		
Feb. 1999	None			
July 1999	None			
Aug. 2000	20	1031		
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E12: Item with Maxwell Elastoflex 72, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 213.2 (ft)	Crack Number	Distance from MP 213.2 (ft)
Oct. 1998	1*	20	11* #	610
	2*	84	12* #	666
	3*	112	13* #	713
	4*	162	14* #	755
	5*	229	15*	824
	6*	290	16* #	869
	7*	370	17* #	924
	8* #	427	18* #	979
	9* #	488	19* #	1000
	10* # †	528	20* #	1044
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1063 ft

Table E13: Item with Maxwell Elastoflex 72, Simple Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 213.0 (ft)	Crack Number	Distance from MP 213.0 (ft)
Oct. 1998	1*	14	12* #	550
	2*	61	13* #	594
	3*	106	14* #	638
	4*	143	15* #	715
	5*	219	16* # †	743
	6*	254	17* #	793
	7*	321	18* #	836
	8*	370	19* #	899
	9*	421	20* #	949
	10*	472	21* #	1011
	11* #	508	22* #	1057
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	23	680		
	24	874		
Sept. 2001	None			
Feb. 2002	25	177		
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1063 ft

Table E14: Item with Maxwell Elastoflex 72, Square Reservoir and Recess

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 212.8 (ft)	Crack Number	Distance from MP 212.8 (ft)
Oct. 1998	1*	81	12*	581
	2*	118	13* # †	635
	3*	154	14* #	677
	4*	181	15* #	715
	5*	230	16* #	770
	6*	281	17* #	818
	7*	346	18* #	870
	8*	385	19* #	930
	9* #	422	20*	970
	10* #	465	21* #	999
	11* #	513	22* #	1029
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	23	44		
Feb. 2002	24**	0		
	25	563		
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft
** crack propagated only ½ of the transverse section of the road

Table E15: Item with Maxwell Elastoflex 72, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 212.6 (ft)	Crack Number	Distance from MP 212.6 (ft)
Oct. 1998	1*	34	11* # †	552
	2*	97	12* #	656
	3*	140	13* #	707
	4*	189	14* #	761
	5*	234	15* #	810
	6*	257	16* #	864
	7* #	339	17*	911
	8* #	388	18* #	950
	9* #	469	19* #	1003
	10* #	505		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	20	608		
Feb. 2002	21	430		
Aug. 2002	None			
May 2003	22	620		

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1061 ft

Table E16: Item with Crafco 522, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 212.2 (ft)	Crack Number	Distance from MP 212.2 (ft)
Oct. 1998	1*	60	12* #	598
	2*	94	13* # †	648
	3*	157	14* #	711
	4*	199	15* #	756
	5*	224	16* #	789
	6*	294	17* #	828
	7*	352	18* #	887
	8*	405	19* #	920
	9*	451	20* #	966
	10*	479	21* #	991
	11* #	552	22* #	1037
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E17: Item with Crafco 522, Square Reservoir and Recess

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 212.0 (ft)	Crack Number	Distance from MP 212.0 (ft)
Oct. 1998	1*	30	11* #	611
	2*	79	12* #	642
	3*	144	13* #	698
	4*	219	14* #	751
	5*	265	15* #	810
	6*	321	16* #	841
	7*	376	17* #	902
	8* †	414	18* #	949
	9* #	454	19* #	998
	10* #	539	20* #	1061
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	None			
Feb. 2002	21**	937		
	22	1036		
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1063 ft
** crack propagated only ½ of the transverse section of the road

Table E18: Item with Crafco 522, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 211.8 (ft)	Crack Number	Distance from MP 211.8 (ft)
Oct. 1998	1*	57	11* #	575
	2*	106	12* #	617
	3*	145	13* #	658
	4*	182	14*	695
	5*	240	15* #	765
	6* #	309	16*	818
	7* #	341	17* #	873
	8* #	374	18* #	946
	9* #	398	19*#	1011
	10* # †	485		
Feb. 1999	None			
July 1999	None			
Aug. 2000	20	978		
April 2001	None			
Sept. 2001	21	730		
Feb.2002	22**	447		
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1060 ft
** crack propagated only ½ of the transverse section of the road

Table E19: Item with Crafco 522, Simple Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 211.6 (ft)	Crack Number	Distance from MP 211.6 (ft)
Oct. 1998	1*	42	12* #	622
	2*	100	13* #	672
	3*	170	14* #	709
	4*	236	15* #	742
	5*	282	16* #	769
	6*	356	17*	803
	7*	397	18* #	834
	8*	435	19* #	876
	9*	495	20* #	930
	10* # †	517	21* #	989
	11* #	562	22* #	1020
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	23	13		
	24	308		
	25**	595		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft
** crack propagated only ½ of the transverse section of the road

Table E20: Item with Crafco 522, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 211.4 (ft)	Crack Number	Distance from MP 211.4 (ft)
Oct. 1998	1*	11	13* #	567
	2*	45	14* #	632
	3*	102	15* #	703
	4*	140	16* #	737
	5*	163	17* #	793
	6*	188	18*	842
	7*	277	19* #	883
	8*	334	20* #	928
	9*	380	21* #	951
	10*	431	22* #	995
	11* # †	476	23* #	1037
	12* #	518		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	24	78		
Sept. 2001	None			
Feb. 2002	25***	403		
Aug. 2002	26	227		
	27***	822		
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1056 ft
** crack propagated only ¾ th of the transverse section of the road

Table E21: Item with Maxwell Elastoflex 71, Square Reservoir and Recess

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 211.0 (ft)	Crack Number	Distance from MP 211.0 (ft)
Oct. 1998	1*	36	12* #	611
	2*	67	13* #	651
	3*	133	14* #	686
	4*	202	15* #	738
	5*	245	16* #	792
	6*	334	17* #	844
	7*	401	18* #	893
	8* #	435	19*	932
	9* #	480	20* #	971
	10* #	532	21*	1025
	11* # †	568		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	22	313		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1059 ft

Table E22: Item with Maxwell Elastoflex 71, Square Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 210.8 (ft)	Crack Number	Distance from MP 210.8 (ft)
Oct. 1998	1*	1	13* #	487
	2*	28	14* #	515
	3*	63	15* # †	603
	4*	112	16* #	646
	5*	189	17* #	672
	6*	252	18*	739
	7*	293	19* #	787
	8*	329	20* #	856
	9*	378	21* #	893
	10* #	407	22* #	945
	11*	431	23* #	1021
	12* #	468		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	24	998		
Sept. 2001	25	834		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1062 ft

Table E23: Item with Maxwell Elastoflex 71, Simple Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 210.6 (ft)	Crack Number	Distance from MP 210.6 (ft)
Oct. 1998	1*	20	9*	635
	2*	57	10*#	673
	3*	145	11* #	721
	4* #	220	12* #	772
	5* #	291	13* #	825
	6*#	435	14* #	884
	7* # †	499	15* #	947
	8* #	574	16* #	1026
Feb. 1999	None			
July 1999	None			
Aug. 2000	17	375		
April 2001	None			
Sept. 2001	18	332		
Feb. 2002	19	111		
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1058 ft

Table E24: Item with Maxwell Elastoflex 71, Shallow Reservoir and Flush

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 210.4 (ft)	Crack Number	Distance from MP 210.4 (ft)
Oct. 1998	1*	27	10* #	623
	2*	97	11* #	688
	3*	145	12* #	738
	4*	224	13* #	793
	5*	328	14* #	836
	6* #	367	15* #	894
	7* #	420	16* #	943
	8* #	484	17* #	1026
	9* # †	544		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1058 ft

Table E25: Item with Maxwell Elastoflex 71, Square Reservoir and Band-Aid

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 210.2 (ft)	Crack Number	Distance from MP 210.2 (ft)
Oct. 1998	1*	47	11* # †	581
	2*	116	12* #	603
	3*	158	13* #	649
	4*	221	14* #	729
	5*	272	15* #	791
	6*	341	16* #	855
	7*	376	17* #	883
	8* #	421	18* #	960
	9* #	485	19* #	1002
	10* #	524		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	20	3		
Sept. 2001	None			
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1058 ft

Table E26: Control Item

Full-Width Transverse Cracks[a]				
Date of Inspection	Crack Number	Distance from MP 209.8 (ft)	Crack Number	Distance from MP 209.8 (ft)
Oct. 1998	1*	10	14* #	582
	2*	52	15* # †	629
	3*	105	16* #	685
	4*	136	17* #	758
	5*	162	18* #	801
	6*	215	19* #	829
	7*	242	20* #	861
	8*	268	21* #	913
	9*	316	22* #	944
	10*	389	23* #	971
	11*	459	24* #	1010
	12*	489	25* #	1030
	13*	546		
Feb. 1999	None			
July 1999	None			
Aug. 2000	None			
April 2001	None			
Sept. 2001	26	191		
	27	351		
	28	422		
	29	520		
	30	709		
Feb. 2002	None			
Aug. 2002	None			
May 2003	None			

[a] each crack extends from shoulder stripe to shoulder stripe (* = sealed full length)
crack is part of the evaluation program
† crack has masonry nails installed for movement measurements
Length of section = 1058 ft

Appendix F

Coin Tests

Table F1: Coin Test for Sealants at the Conrad Site

Date	Material	Replicate Test	Sealant Temp. (°F)	Parameter		Comment
				Ease of Penetration	Recovery in 60 seconds	
July 1998	Crafco 221	1	95	Hard	50%	
	Maxwell 60	1	105	Easy	75%	
	Crafco 231	1	100	Easy	100%	
May 1999	Crafco 221	1	58	Hard	50%	
		2	58	Hard	50%	
	Maxwell 60	1	64	Hard	50%	
		2	64	Hard	50%	
	Crafco 231	1	61	Easy	75%	
		2	61	Easy	75%	
June 2000	Crafco 221	1	70	Hard	75%	
		2	69	Hard	75%	
	Maxwell 60	1	73	Easy	75%	
		2	72	Easy	75%	
	Crafco 231	1	76	Easy	100%	
		2	76	Easy	75%	
April 2001	Coin tests not performed.					

Table F2: Coin Test for Sealants at the Dutton Site

Date	Material	Replicate Test	Sealant Temp. (°F)	Parameter		Comment
				Ease of Penetration	Recovery in 60 seconds	
July 1998	Crafco 299	1	60	Easy	75%	
	Crafco 516	1	65	Hard	50%	
	Crafco 522	1	65	Easy	75%	
	Crafco 231	1	65	Easy	75%	
May 1999	Crafco 299	1	73	Easy	75%	
		2	73	Easy	75%	
	Crafco 516	1	71	Hard	50%	
		2	71	Hard	50%	
	Crafco 522	1	74	Easy	75%	
		2	74	Easy	75%	
	Crafco 231	1	69	Easy	75%	
		2	69	Easy	100%	
June 2000	Crafco 299	1	88	Easy	50%	
		2	88	Easy	50%	
	Crafco 516	1	79	Hard	50%	
		2	79	Hard	75%	
	Crafco 522	1	80	Easy	75%	
		2	85	Easy	75%	
	Crafco 231	1	91	Easy	75%	
		2	91	Easy	75%	

Table F3: Coin Test for Sealants at the Tarkio Site

Date	Material	Replicate Test	Sealant Temp. (°F)	Parameter		Comment
				Ease of Penetration	Recovery in 60 seconds	
Aug. 1998	Crafco 231	1	80	Easy	100%	
	Crafco 522	1	85	Easy	75%	Sticky
	Maxwell 72	1	90	Easy	75%	Less Resilient
	Crafco 221	1	105	Easy	100%	
March 1999	No coin test was performed in 1999 due to pavement temperatures less than 50°F at evaluation time.					
Aug. 1999	Coin tests were not performed.					
Sept. 2000	Coin tests were not performed.					
May 2001	Crafco 231	1	67	Easy	75%	
		2	65	Easy	75%	
	Crafco 522	1	61	Easy	50%	
		2	55	Easy	75%	
	Maxwell 72	1	55	Hard	50%	
		2	55	Hard	25%	
	Crafco 221	1	53	Hard	25%	
		2	56	Hard	50%	

Table F4: Coin Test for Sealants at the Helena Site

Date	Material	Replicate Test	Sealant Temp. (°F)	Parameter		Comment
				Ease of Penetration	Recovery in 60 seconds	
Oct. 1998	Deery 101 ELT	1	62	Hard	50%	Sticky
		2	62	Hard	50%	Sticky
	Crafco 231	1	62	Hard	75%	
		2	63	Hard	75%	Sticky
	Maxwell 72	1	63	Hard	50%	Sticky
		2	62	Hard	75%	
	Crafco 522	1	62	Easy	75%	
		2	63	Easy	100%	
	Maxwell 71	1	62	Hard	75%	
		2	62	Hard	75%	
July 1999	Deery 101 ELT	1	67	Hard	50%	
		2	67	Hard	50%	
	Crafco 231	1	69	Hard	75%	
		2	68	Hard	75%	
	Maxwell 72	1	66	Hard	50%	
		2	67	Hard	50%	
	Crafco 522	1	62	Easy	75%	
		2	64	Easy	100%	
	Maxwell 71	1	67	Hard	75%	
		2	67	Hard	75%	
Aug. 2000	Coin tests not performed					
April 2001	Coin tests not performed					
Sept. 2001	Deery 101 ELT	1	85	Hard	25%	
		2	92	Hard	25%	
	Crafco 231	1	82	Hard	50%	
	Maxwell 72	1	64	Hard	25%	
	Crafco 522	1	73	Hard	50%	
		2	91	Hard	50%	
	Maxwell 71	Coin tests not performed				
Feb. 2002	No coin tests were performed due to pavement temperatures less than 50°F at the time of evaluation.					
May 2002	Coin tests not performed					
August 2002	Deery 101 ELT	1	77	Hard	50%	
	Crafco 231	1	83	Hard	50%	
	Maxwell 72	1	87	Hard	25%	
	Crafco 522	1	94	Hard	50%	
	Maxwell 71	1	95	Hard	25%	
May 2003	Coin tests not performed					

Appendix G

Pavement Movement Measurements

Table G1: Distances (in.) Between Masonry Nails and Associated Pavement Surface Temperatures (ºF) at Conrad Site

LOCATION	July 1998		August 1998		May 1999		June 2000		April 2001	
	in.	ºF	in.	ºF	in.	ºF	in.	ºF	in.	ºF
5 ft. from MP 354.3	10.98	90	11.02	81	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
37 ft. from MP 354.5	11.54	92	11.54	84	11.54	66	11.57	66	11.65	53
1028 ft. from MP 354.5	9.17	90	9.17	86	9.17	68	8.82	69	---	---
998 ft. from MP 354.7	11.30	95	11.30	75	11.14	73	11.30	68	11.33	55
1019 ft. from MP 354.9	8.43	97	8.43	77	8.61	75	8.46	65	8.51	56
1028 ft. from MP 355.1	8.50	97	8.50	91	8.54	73	8.54	63	8.98	52
1035 ft. from MP 355.4	9.02	97	9.02	86	9.02	80	9.06	65	9.09	53
1047 ft. from MP 355.6	11.89	97	11.93	88	11.93	89	11.89	52	12.05	52
1052 ft. from MP 355.8	13.23	99	13.27	95	13.31	89	13.27	62	13.39	51
941 ft. from MP 356.0	10.39	108	10.39	91	10.39	90	10.39	62	10.47	52
1108 ft. from MP 356.2	9.45	106	9.41	97	9.41	92	9.45	63	9.57	49
529 ft. from MP 356.4	14.17	111	14.17	99	14.13	97	14.17	64	14.19	48
931 ft. from MP 356.7	7.44	104	7.44	93	7.48	71	7.52	78	---	---
1057 ft. from MP 356.9	10.94	104	10.94	95	10.94	67	10.98	81	---	---
1021 ft. from MP 357.1	7.20	109	7.20	95	7.28	66	7.36	77	---	---
1012 ft. from MP 357.3	7.72	111	7.72	99	7.76	64	7.80	76	---	---
1005 ft. from MP 357.5	6.93	117	6.93	99	7.01	64	7.09	76	---	---
789 ft. from MP 357.7	6.89	111	6.89	99	6.93	60	6.93	76	---	---
1013 ft. from MP 358.0	7.28	100	7.28	106	7.24	100	7.24	64	7.32	52
1026 ft. from MP 358.2	9.96	102	9.96	106	10.00	101	10.00	64	---	---
868 ft. from MP 358.4	10.04	97	10.08	106	10.08	101	10.08	63	10.15	44
928 ft. from MP 358.6	6.85	99	6.85	106	6.93	101	6.89	66	6.97	50
991 ft. from MP 358.8	9.69	95	9.69	108	9.72	105	9.69	62	9.80	46
1013 ft. from MP 359.0	11.77	100	11.81	111	11.85	108	11.81	62	11.93	41
1020 ft. from MP 359.3	10.59	97	10.59	111	10.63	65	10.60	63	---	---
1019 ft. from MP 359.5	9.84	97	9.88	109	9.88	57	9.88	61	---	---
966 ft. from MP 359.7	11.14	97	11.14	111	11.18	60	11.16	64	---	---
964 ft. from MP 359.9	7.44	97	7.48	111	7.48	59	7.47	62	---	---
1012 ft. from MP 360.1	8.50	100	8.50	111	8.50	61	8.50	65	---	---
1036 ft. from MP 360.3	9.65	99	9.69	111	9.57	63	9.62	66	---	---

Note: Masonry nails for movement are located in traveling lane, near the shoulder stripe
[a] Nail removed by milling operation in Spring 1999.
--- No data recorded.

Table G2: Measurements (in.) Between Masonry Nails and Pavement Surface Temperatures (ºF) at Dutton Site

LOCATION	July 1998		May 1999		June 2000	
	in.	ºF	in.	ºF	in.	ºF
63 ft. from MP 316.8	8.58	53	8.58	121	8.58	74
1304 ft. from MP 316.8	12.13	66	12.13	114	12.17	74
1262 ft. from MP 316.5	13.50	66	13.50	114	13.50	73
742 ft. from MP 316.3	11.38	66	11.38	110	11.38	72
980 ft. from MP 316.1	7.17	66	7.36	107	6.73	72
567 ft. from MP 315.9	7.99	68	7.99	100	8.03	73
585 ft. from MP 315.8	10.00	70	10.00	105	13.94	74
825 ft. from MP 315.7	13.50	70	13.50	113	13.54	77
220 ft. from MP 315.5	11.10	70	11.06	114	11.10	74

Note: Masonry nails for movement are located in passing lane, near the shoulder stripe

Table G3: Measurements (in.) Between Masonry Nails and Pavement Surface Temperatures (ºF) at Tarkio Site

LOCATION	August 1998		March 1999		September 2000		May 2001	
	in.	ºF	in.	ºF	in.	ºF	in.	ºF
341 ft. from MP 61.5	6.77	73	---[a]	---	5.83[b]	69	5.91	68
381 ft. from MP 61.2	8.11	79	8.23	36	8.54	69	8.58	67
776 ft. from MP 61.0	8.15	79	8.19	44	8.27	71	---[a]	---[a]
412 ft. from MP 60.8	9.41	81	9.53	37	10.87[b]	73	10.87	63
369 ft. from MP 60.4	6.93	82	7.05	42	7.04	72	7.13	65
547 ft. from MP 60.1	8.39	83	8.43	39	7.87[b]	68	7.87	61
793 ft. from MP 59.9	8.74	83	8.82	42	8.58	71	8.62	55
631 ft. from MP 59.7	9.88	87	10.00	42	10.03	67	10.08	55
310 ft. from MP 59.5	11.18	91	11.22	42	12.76[b]	71	12.76	55
819 ft. from MP 59.3	8.07	88	8.11	42	8.62	68	8.74	53
624 ft. from MP 59.0	9.33	87	9.41	40	9.17	66	8.86	55
223 ft. from MP 58.8	10.12	95	---[a]	---[a]	12.40[b]	68	12.44	55
530 ft. from MP 57.7	7.72	105	7.80	42	7.04	72	7.17	53
744 ft. from MP 57.5	14.80	110	---[a]	---[a]	13.50[b]	71	13.58	55
481 ft. from MP 57.3	9.65	108	---[a]	---[a]	7.84[b]	73	7.76[c]	56

Note: Masonry nails for movement are located in traveling lane, near the shoulder stripe
[a] Unable to locate masonry nails
[b] New nails were put in place
[c] Apparent damage to masonry nail
--- No data recorded

Table G4: Measurements (in.) Between Masonry Nails and Pavement Surface Temperatures (ºF) at Helena Site

LOCATION	October 1998		February 1999		July 1999		August 2000		April 2001		Sept. 2001	
	in.	ºF	in.	ºF	in.	ºF	in.	ºF	in.	ºF	in.	ºF
404 ft. from MP 215.8	8.15	65	8.15	43	8.11	50	8.11	83	8.14	69	8.07	85
633 ft. from MP 215.6	8.23	64	8.23	44	8.23	46	8.23	86	8.27	63	8.15	92
629 ft. from MP 215.4	9.41	65	9.37	42	9.41	49	9.37	88	9.41	67	9.37	89
689 ft. from MP 215.2	8.19	74	8.15	44	8.19	54	8.11	78	8.15	63	8.07	94
619 ft. from MP 215.0	10.31	78	10.35	41	10.31	51	10.31	86	10.35	61	10.31	80
764 ft. from MP 214.6	9.17	74	9.13	42	9.13	54	7.95	92	9.17	63	9.25	82
830 ft. from MP 214.4	7.68	76	7.72	43	7.68	55	7.68	91	7.76	64	7.87	93
718 ft. from MP 214.2	8.15	77	8.15	42	8.15	56	8.15	85	8.19	63	8.27	88
672 ft. from MP 214.0	6.65	78	6.69	41	6.65	54	6.65	90	6.69	64	6.69	85
585 ft. from MP 213.8	8.07	78	8.07	41	8.07	56	8.03	86	8.11	62	7.87	83
484 ft. from MP 213.4	7.36	78	7.36	27	7.32	56	7.82	89	7.40	62	7.32	54
526 ft. from MP 213.2	7.60	77	7.64	27	7.60	55	7.60	99	7.60	63	7.52	58
740 ft. from MP 213.0	9.45	76	9.49	30	9.45	57	9.41	100	9.49	67	9.45	59
640 ft. from MP 212.8	7.40	75	7.48	34	7.44	59	7.40	101	7.48	68	7.40	63
551 ft. from MP 212.6	7.32	75	7.40	36	7.32	56	7.28	95	7.76	61	7.32	64
648 ft. from MP 212.2	6.81	77	6.85	42	6.81	59	6.77	98	6.85	63	6.77	73
414 ft. from MP 212.0	7.76	76	7.76	43	7.76	62	7.72	94	7.80	64	7.72	83
485 ft. from MP 211.8	9.80	78	9.80	46	9.80	69	9.76	95	9.84	64	9.76	86
517 ft. from MP 211.6	8.31	76	8.35	52	8.31	70	8.35	92	8.39	66	8.31	82
476 ft. from MP 211.4	7.40	77	7.44	49	7.40	81	7.36	91	7.40	64	7.32	91
568 ft. from MP 211.0	7.83	73	7.83	50	7.83	76	7.83	90	7.87	64	7.87	87
603 ft. from MP 210.8	7.60	77	7.64	52	7.56	66	7.56	91	7.64	65	7.68	89
499 ft. from MP 210.6	9.65	77	9.69	54	9.69	76	9.61	91	9.72	63	9.65	91
544 ft. from MP 210.4	7.28	79	7.28	51	7.24	68	7.24	90	7.32	61	7.09	90
581 ft. from MP 210.2	8.07	80	8.11	54	8.07	81	8.07	86	8.11	60	7.87	91
628 ft. from MP 209.8	7.99	77	8.03	58	8.03	89	*	87	9.25	61	8.07	83

Notes: Masonry nails for movement are located in traveling lane, near the shoulder stripe

continued

Table G4: Measurements (in.) Between Masonry Nails and Pavement Surface Temperatures (ºF) at Helena Site (cont'd)

LOCATION	February 2002		May 2002		August 2002		May 2003	
	in.	ºF	in.	ºF	in.	ºF	in.	ºF
404 ft. from MP 215.8	8.11	37	←	←	8.07	80.8	8.07	38.4
633 ft. from MP 215.6	8.31	32	←	←	8.23	76	8.27	37.8
629 ft. from MP 215.4	9.41	31	←	←	9.39	76.3	9.37	33
689 ft. from MP 215.2	8.15	29	←	←	8.11	77.8	8.27	36.5
619 ft. from MP 215.0	10.35	33	←	←	10.33	75.5	10.35	39.6
764 ft. from MP 214.6	→	→	9.13	40	9.13	72.5	9.13	40.5
830 ft. from MP 214.4	→	→	7.72	46	7.68	82.3	7.80	41
718 ft. from MP 214.2	→	→	8.15	42	8.15	84.9	8.19	45.8
672 ft. from MP 214.0	→	→	6.73	43	6.67	87.8	6.69	46.8
585 ft. from MP 213.8	→	→	8.07	45	8.05	86	8.07	49.2
484 ft. from MP 213.4	→	→	7.32	53	7.32	83.6	7.36	55.2
526 ft. from MP 213.2	→	→	7.56	55	7.56	87.1	7.56	63.3
740 ft. from MP 213.0	→	→	9.45	60	9.45	91.4	9.53	55.4
640 ft. from MP 212.8	→	→	7.44	62	7.44	85	7.44	56.9
551 ft. from MP 212.6	→	→	7.32	62	7.32	88.5	7.36	56.3
648 ft. from MP 212.2	6.85	56	←	←	6.79	93	6.81	55.6
414 ft. from MP 212.0	7.70	54	←	←	7.76	93.7	7.76	59.9
485 ft. from MP 211.8	9.74	53	←	←	9.80	94	9.80	63.3
517 ft. from MP 211.6	8.35	50	←	←	8.35	93.3	8.35	65.4
476 ft. from MP 211.4	7.36	51	←	←	7.40	94.3	7.40	66.5
568 ft. from MP 211.0	7.81	60	←	←	7.81	93.7	7.80	59.6
603 ft. from MP 210.8	7.56	56	←	←	7.58	98.7	7.60	60.1
499 ft. from MP 210.6	9.65	55	←	←	9.69	90.1	9.76	61.6
544 ft. from MP 210.4	7.24	53	←	←	7.28	94.5	8.11	61.6
581 ft. from MP 210.2	8.03	51	←	←	8.07	96.2	8.11	61.6
628 ft. from MP 209.8	8.07	52	←	←	8.07	98.9	8.11	68.4

Notes: Masonry nails for movement are located in traveling lane, near the shoulder stripe.
Data not recorded in February 2002 was collected during the second visit in May 2002.

Appendix H
Condition Survey Results for the Conrad Site

Table H1: Full-Width Transverse Cracks for Crafco 221, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	0.00	0.00	0.00	0.00	19.14	19.14	W(1)
	cv (%)	---	---	---	---	52.11	52.11	
July 1998	average	9.33	0.00	9.20	0.00	31.77	40.84	W(2)
	cv (%)	85.14	---	87.20	---	27.44	37.34	
May 1999	average	7.47	0.00	6.77	0.00	32.42	39.06	W(2)
	cv (%)	30.65	---	51.14	---	25.91	23.92	
June 2000	average	3.78	0.00	3.78	0.00	31.73	35.37	W(2)
	cv (%)	73.80	---	73.80	---	38.38	39.40	
April 2001	average	9.07	1.17	10.24	0.00	32.55	42.66	W(2)
	cv (%)	52.50	282.84	29.88	---	28.08	23.92	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H2: Full-Width Transverse Cracks for Crafco 221, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	1.04	0.00	1.04	0.00	1.69	2.73	W(2)
	cv (%)	282.84	---	282.84	---	179.98	136.50	
July 1998	average	3.78	0.00	3.69	0.00	10.76	14.73	W(2),WR(2)
	cv (%)	71.98	---	71.14	---	65.25	58.62	
May 1999	average	3.99	0.00	3.99	0.00	12.11	16.02	W(2),WR(2)
	cv (%)	67.99	---	67.99	---	49.93	36.89	
June 2000	average	1.95	0.00	1.95	0.00	9.51	11.37	W(2),WR(2)
	cv (%)	103.63	---	103.63	---	58.25	48.82	
April 2001	average	40.32	0.00	40.32	0.00	14.63	54.86	W(2),WR(2)
	cv (%)	32.25	---	32.25	---	50.43	21.20	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H3: Full-Width Transverse Cracks for Crafco 221, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1997	average	78.65	0.00	78.65	0.52	0.00	79.17	
	cv (%)	42.73	---	42.73	282.84	---	42.87	
July 1998	average	82.81	0.00	82.29	0.52	0.00	82.81	WR(2)
	cv (%)	41.77	---	41.71	282.84	---	41.77	
May 1999	average	82.64	0.00	82.64	0.00	0.00	82.64	WR(2)
	cv (%)	41.40	---	41.40	---	---	41.40	
June 2000	average	0.00	162.80	162.63	1.17	1.91	165.71	WR(2)
	cv (%)	---	153.82	---	108.51	168.05	150.35	
April 2001	average	---	100.00	100.00	---	---	100.00	WR(2)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H4: Full-Width Transverse Cracks for Crafco 221, Square Reservoir and Recess

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1997	average	28.52	0.00	28.52	0.00	29.04	57.55	W(1)
	cv (%)	85.99	---	85.89	---	66.44	21.56	
July 1998	average	20.70	0.00	20.10	0.00	50.04	69.53	W(2)
	cv (%)	44.52	---	40.87	---	44.77	28.65	
May 1999	average	20.23	0.00	19.66	0.00	49.48	68.53	W(2)
	cv (%)	44.16	---	43.73	---	47.81	32.24	
June 2000	average	5.73	0.78	6.03	4.77	36.24	46.44	W(2)
	cv (%)	77.61	282.84	86.19	171.12	21.16	20.84	
April 2001	average	29.82	0.00	28.99	2.26	37.98	68.62	W(2)
	cv (%)	56.25	---	58.49	163.64	60.76	52.23	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H5: Full-Width Transverse Cracks for Crafco 221, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	4.17	0.00	4.17	1.43	0.00	5.60	
	cv (%)	65.47	---	65.47	128.56	---	45.50	
July 1998	average	38.02	0.00	38.02	0.78	0.00	38.80	
	cv (%)	49.51	---	49.51	118.19	---	49.24	
May 1999	average	35.85	0.00	35.85	1.35	2.99	40.19	
	cv (%)	44.16	---	44.16	70.93	137.32	29.23	
June 2000	average	0.00	25.65	25.65	1.74	4.38	31.77	
	cv (%)	---	41.61	41.61	125.13	90.21	23.99	
April 2001	average	---	100.00	100.00	---	---	100.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H6: Longitudinal Centerline Cracks for Crafco 221, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total	Superficial Distress
May 1999	No Data							W(1)
June 2000	No Data							

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H7: Longitudinal Centerline Cracks for Crafco 221, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.00	0.00	0.00	0.00	0.49	0.49	W(1),WR(1)
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.33	0.00	0.33	0.00	8.44	8.78	W(1),WR(1)
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.33	0.00	0.33	0.00	24.00	24.33	W(1),WR(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H8: Longitudinal Centerline Cracks for Crafco 221, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.00	0.00	0.00	0.00	0.28	0.28	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	33.67	33.67	0.00	0.00	33.67	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H9: Longitudinal Centerline Cracks for Crafco 221, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.33	0.00	0.33	0.00	1.85	2.17	W(1)
	cv (%)	---	---	---	---	---	---	
June 2000	average	1.65	0.00	1.60	0.00	13.88	15.47	W(1)
	cv (%)	141.42	---	141.42	---	129.25	130.50	
April 2001	average	0.00	0.00	0.00	0.00	23.42	23.42	W(1)
	cv (%)	---	---	---	---	128.34	128.34	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H10: Longitudinal Centerline Cracks for Crafco 221, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.00	0.00	0.00	1.22	0.28	1.22	
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.00	0.00	0.00	19.61	8.97	28.58	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	24.33	11.67	36.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H11: Full-Width Transverse Cracks for Maxwell 60, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	10.94	0.00	10.94	0.13	6.77	17.84	W(2)
	cv (%)	70.35	---	70.35	282.84	65.27	53.47	
July 1998	average	8.12	0.00	8.12	0.13	9.33	17.58	W(2)
	cv (%)	78.85	---	78.85	282.84	40.24	53.40	
May 1999	average	9.20	0.00	8.51	0.00	12.11	20.62	W(2)
	cv (%)	55.02	---	59.83	---	43.50	46.76	
June 2000	average	4.90	0.00	4.90	1.17	10.37	15.45	W(2)
	cv (%)	125.25	---	125.25	282.84	61.08	58.48	
April 2001	average	36.50	0.00	36.33	0.00	6.68	43.01	W(2)
	cv (%)	96.39	---	96.73	---	92.17	90.95	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H12: Full-Width Transverse Cracks for Maxwell 60, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	4.43	0.00	4.43	0.00	7.29	11.72	W(2)
	cv (%)	116.46	---	116.46	---	103.58	64.41	
July 1998	average	3.60	0.00	3.60	0.00	8.68	8.68	W(2), ,SI(2), WR(2)
	cv (%)	80.30	---	80.30	---	60.47	52.54	
May 1999	average	10.29	0.00	10.29	0.00	14.15	14.15	W(2), SI(2), WR(2)
	cv (%)	145.96	---	145.96	---	41.52	70.32	
June 2000	average	2.39	1.69	3.86	0.00	12.24	12.24	W(2), SI(2), WR(2)
	cv (%)	115.96	---	112.52	---	52.02	44.42	
April 2001	average	73.61	0.00	72.40	0.00	12.28	12.28	W(2), SI(2), WR(2)
	cv (%)	22.50	---	20.15	---	45.15	45.15	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H13: Full-Width Transverse Cracks for Maxwell 60, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	25.00	0.00	25.00	0.00	0.00	25.00	W(2)
	cv (%)	59.76	---	59.76	---	---	59.76	
July 1998	average	41.41	0.00	41.41	0.39	0.00	41.80	W(2)
	cv (%)	52.04	---	52.04	282.84	---	50.38	
May 1999	average	78.26	0.00	78.26	0.00	0.00	78.26	W(2)
	cv (%)	20.89	---	20.89	---	---	20.89	
June 2000	average	5.69	72.48	78.17	0.52	0.52	79.21	W(2)
	cv (%)	282.84	32.74	12.56	198.41	188.56	11.22	
April 2001	average	---	100.00	100.00	---	---	100.00	W(2)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H14: Full-Width Transverse Cracks for Maxwell 60, Square Reservoir and Recess

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	8.33	0.00	8.33	0.00	7.29	15.63	W(2)
	cv (%)	160.36	---	160.36	---	95.37	112.01	
July 1998	average	8.94	0.00	8.94	0.00	15.10	24.05	W(3),SI(1)
	cv (%)	108.22	---	108.22	---	58.61	61.98	
May 1999	average	8.16	0.00	8.16	0.00	15.54	23.70	W(3),SI(1)
	cv (%)	53.39	---	53.39	---	59.48	36.82	
June 2000	average	9.38	0.00	9.38	0.00	9.72	19.10	W(3),SI(1)
	cv (%)	76.37	---	76.37	---	69.99	49.25	
April 2001	average	---	100.00	100.00	---	---	100.00	W(3),SI(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H15: Full-Width Transverse Cracks for Maxwell 60, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	6.25	0.00	6.25	1.56	0.00	7.81	W(1)
	cv (%)	136.86	---	136.86	118.19	---	115.58	
July 1998	average	6.60	0.00	6.60	1.56	0.00	7.86	W(1)
	cv (%)	164.31	---	164.31	151.77	---	138.52	
May 1999	average	12.37	0.00	12.37	1.26	0.69	14.32	W(1)
	cv (%)	74.01	---	74.01	139.84	213.81	65.02	
June 2000	average	0.00	15.58	15.58	1.52	2.13	19.23	W(1)
	cv (%)	---	56.99	56.99	127.52	194.44	52.20	
April 2001	average	---	100.00	100.00	---	---	100.00	W(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H16: Full-Width Transverse Cracks for Maxwell 60, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	0.00	0.00	0.00	0.00	2.26	2.26	
	cv (%)	---	---	---	---	183.59	183.59	
July 1998	average	0.81	0.00	0.81	0.00	4.32	5.14	B(1),W(2), ,SI(2)
	cv (%)	100.39	---	100.39	---	117.21	96.92	
May 1999	average	1.19	0.00	1.19	0.00	6.52	7.71	B(1),W(2), SI(2)
	cv (%)	132.35	---	132.35	---	83.11	68.68	
June 2000	average	0.06	0.00	0.06	0.00	6.27	6.33	B(1),W(2), SI(2)
	cv (%)	264.58	---	264.58	---	60.72	58.24	
April 2001	average	27.69	0.00	27.69	0.00	9.65	37.34	B(1),W(2), SI(2)
	cv (%)	33.46	---	33.46	---	38.92	21.92	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H17: Longitudinal Centerline Cracks for Maxwell 60, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.44	0.00	0.25	0.08	23.72	60.08	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	0.08	60.00	24.06	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H18: Longitudinal Centerline Cracks for Maxwell 60, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.00	0.00	0.00	0.00	1.58	1.58	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	0.00	3.67	3.67	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H19: Longitudinal Centerline Cracks for Maxwell 60, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.00	41.08	40.89	1.53	1.94	44.36	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	100.00	100.00	0.00	0.00	100.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H20: Longitudinal Centerline Cracks for Maxwell 60, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.88	0.00	0.88	0.00	1.67	2.49	W(1)
	cv (%)	---	---	---	---	---	---	
June 2000	average	16.08	0.00	15.97	0.00	21.25	37.22	W(1)
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	0.00	0.00	0.00	W(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H21: Longitudinal Centerline Cracks for Maxwell 60, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.00	0.00	0.00	0.00	0.21	0.21	None
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.00	0.00	0.00	0.19	5.11	5.31	None
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	100.00	100.00	0.00	0.00	100.00	None
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H22: Longitudinal Centerline Cracks for Maxwell 60, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	average	0.00	0.00	0.00	0.00	1.30	1.30	W(1)
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.00	0.00	0.00	0.00	6.84	6.84	W(1)
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	0.00	6.54	6.54	W(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H23: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1997	average	3.39	0.00	3.39	0.00	4.82	8.20	W(2),SI(2)
	cv (%)	173.86	---	173.86	---	141.99	105.69	
July 1998	average	14.84	0.00	14.63	0.00	5.69	20.14	W(2),SI(3)
	cv (%)	155.49	---	157.87	---	117.83	107.94	
May 1999	average	4.77	0.00	4.77	0.00	8.72	13.32	W(2),SI(3)
	cv (%)	114.25	---	114.25	---	111.49	65.17	
June 2000	average	7.25	0.00	7.25	0.17	9.29	16.54	W(2),SI(3)
	cv (%)	96.91	---	96.91	282.84	106.78	61.73	
April 2001	average	9.46	0.00	9.46	0.00	8.64	17.93	W(2),SI(3)
	cv (%)	103.59	---	103.59	---	107.28	56.37	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H24: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	0.00	0.00	0.00	0.00	2.34	2.34	W(2),SI(3)
	cv (%)	---	---	---	---	129.58	129.58	
July 1998	average	3.08	0.00	3.08	0.00	4.69	7.77	W(2),SI(3),WR(1)
	cv (%)	58.22	---	58.22	---	43.73	39.39	
May 1999	average	0.04	0.00	0.04	0.00	9.07	9.11	W(2),SI(3),WR(1)
	cv (%)	282.84	---	282.84	---	66.72	65.66	
June 2000	average	1.65	0.00	1.35	0.00	9.42	10.76	W(2),SI(3),WR(1)
	cv (%)	102.98	---	135.46	---	50.06	49.07	
April 2001	average	8.94	0.00	8.77	0.00	13.19	21.96	W(2),SI(3),WR(1)
	cv (%)	87.13	---	84.03	---	56.91	42.03	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H25: Full-Width Transverse Cracks for Crafco 231, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	0.00	0.00	0.00	0.00	0.00	0.00	W(1),WR(2)
	cv (%)	---	---	---	---	---	---	
July 1998	average	2.04	0.00	2.04	0.00	0.00	2.04	W(1),WR(2)
	cv (%)	119.82	---	119.82	---	---	119.82	
May 1999	average	13.45	0.00	13.45	0.00	0.00	13.45	W(1),WR(2)
	cv (%)	42.31	---	42.31	---	---	42.31	
June 2000	average	0.00	21.14	21.14	0.00	0.48	21.61	W(1),WR(2)
	cv (%)	---	35.42	35.42	---	194.13	37.47	
April 2001	average	---	100.00	100.00	---	---	100.00	W(1),WR(2)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H26: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Recess

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	47.40	0.00	46.88	0.00	6.90	53.26	W(2),SI(2)
	cv (%)	57.92	---	56.97	---	58.70	50.72	
July 1998	average	57.77	0.00	55.38	0.00	9.72	62.72	W(3),SI(3)
	cv (%)	54.33	---	56.07	---	22.34	47.46	
May 1999	average	46.05	0.00	41.45	0.00	14.32	53.39	W(3),SI(3)
	cv (%)	64.71	---	62.41	---	25.08	51.40	
June 2000	average	36.81	0.00	34.68	0.00	15.63	47.92	W(3),SI(3)
	cv (%)	62.95	---	64.91	---	40.07	46.89	
April 2001	average	---	100.00	100.00	---	---	100.00	W(3),SI(3)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H27: Full-Width Transverse Cracks for Crafco 231, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	2.60	0.00	2.60	0.00	0.00	2.60	WR(2)
	cv (%)	131.80	---	131.80	---	---	131.80	
July 1998	average	4.08	0.00	4.08	0.00	0.00	4.08	WR(2)
	cv (%)	105.59	---	105.59	---	---	105.59	
May 1999	average	9.03	0.00	9.03	1.17	2.34	12.54	WR(2)
	cv (%)	47.33	---	47.33	145.96	137.79	48.46	
June 2000	average	0.00	16.45	16.45	1.22	2.47	20.14	WR(2)
	cv (%)	---	51.81	51.81	160.17	117.77	52.16	
April 2001	average	---	100.00	100.00	---	---	100.00	WR(2)
	cv (%)	---	---	---	---	---		

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H28: Full-Width Transverse Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1997	average	0.00	0.00	0.00	0.00	0.78	0.78	SI(2)
	cv (%)	---	---	---	---	118.19	118.19	
July 1998	average	3.60	0.00	3.60	0.00	5.69	9.29	W(2),WR(1),SI(3)
	cv (%)	83.38	---	83.38	---	80.82	48.53	
May 1999	average	1.09	0.00	1.09	0.22	5.34	6.64	W(2),WR(1),SI(3)
	cv (%)	139.42	---	139.42	190.04	92.37	90.41	
June 2000	average	0.48	2.30	2.78	0.17	7.20	10.16	W(2),WR(1),SI(3)
	cv (%)	194.13	87.99	56.30	282.84	68.82	38.88	
April 2001	average	5.47	4.17	9.64	0.00	11.59	21.22	W(2),WR(1),SI(3)
	cv (%)	164.23	77.54	99.25	---	46.22	51.98	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table H29: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	---	---	---	---	---	---	
	cv (%)	---	---	---	---	---	---	
April 2001	average	---	---	---	---	---	---	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H30: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	average	0.00	0.00	0.00	0.00	0.04	0.04	W(1)
	cv (%)	---	---	---	---	---	---	
June 2000	average	0.03	0.00	0.03	0.00	0.50	0.53	W(1)
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	4.67	4.67	0.00	0.00	4.67	W(1)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H31: Longitudinal Centerline Cracks for Crafco 231, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.00	0.42	0.22	0.00	2.67	3.50	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	100.00	100.00	0.61	0.00	100.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H32: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	16.92	0.00	16.25	0.00	14.81	31.06	
	cv (%)	---	---	---	---	---	---	
April 2001	average	---	100.00	100.00	---	---	100.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H33: Longitudinal Centerline Cracks for Crafco 231, Capped

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	Material Failures (MF) CF (%)	Material Failures (MF) Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.00	0.00	0.00	2.50	5.14	7.64	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	100.00	100.00	0.00	0.00	100.00	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table H34: Longitudinal Centerline Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	Material Failures (MF) CF (%)	Material Failures (MF) Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 2000	average	0.36	0.00	0.17	0.08	11.36	11.61	
	cv (%)	---	---	---	---	---	---	
April 2001	average	0.00	0.00	0.00	0.00	0.50	0.50	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Appendix I
Condition Survey Results for the Dutton Site

Table I1: Full-Width Transverse Cracks for Crafco 299, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
June 1998	average	0.00	0.78	0.78	0.00	8.55	9.33	B(1),W(2), SI(2)
	cv (%)	---	282.84	282.84	---	89.92	101.81	
May 1999	average	1.48	0.00	1.48	0.00	5.95	7.42	B(1),W(2), SI(2)
	cv (%)	282.84	---	282.84	---	84.99	86.95	
June 2000	average	1.39	5.03	5.73	0.00	8.33	14.06	B(1),W(2), SI(2)
	cv (%)	282.84	188.80	177.88	---	101.87	68.16	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated, passing lane only.

Table I2: Full-Width Transverse Cracks for Crafco 516, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
June 1998	average	7.40	31.64	39.04	0.00	7.11	46.15	B(1),W(2), SI(2)
	cv (%)	120.84	102.89	86.62	---	58.80	70.71	
May 1999	average	9.72	27.97	37.69	0.00	15.33	53.02	B(1),W(2), SI(2)
	cv (%)	247.47	61.93	48.25	---	82.65	23.62	
June 2000	average	9.01	22.29	31.30	0.00	18.82	50.12	B(1),W(2), SI(2)
	cv (%)	139.02	77.78	61.20	---	63.83	36.49	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated, passing lane only.

Table I3: Full-Width Transverse Cracks for Crafco 522, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	0.69	0.00	0.69	0.00	13.51	14.21	W(2), SI(2)
	cv (%)	263.22	---	263.22	---	67.38	62.51	
May 1999	average	0.00	0.00	0.00	0.00	12.02	12.02	W(2), SI(2)
	cv (%)	---	---	---	---	80.01	80.01	
June 2000	average	0.00	0.00	0.00	0.00	11.94	11.94	B(1),W(2), SI(2)
	cv (%)	---	---	---	---	77.79	77.79	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table I4: Full-Width Transverse Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	0.09	0.00	0.09	0.00	12.43	12.51	W(2),SI(2)
	cv (%)	185.16	---	185.16	---	46.66	46.92	
May 1999	average	0.00	0.00	0.00	0.00	11.50	13.93	W(2),SI(2)
	cv (%)	---	---	---	---	44.53	44.53	
June 2000	average	0.00	0.00	0.00	0.00	13.93	11.50	W(2),SI(2)
	cv (%)	---	---	---	---	41.50	41.50	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table I5: Full-Width Transverse Cracks for Crafco 516, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	47.73	8.19	53.05	0.00	11.02	68.23	W(2), SI(2)
	cv (%)	67.48	47.46	61.97	---	110.49	29.64	
May 1999	average	20.83	5.56	26.39	0.00	37.59	63.98	W(2), SI(2)
	cv (%)	120.00	122.47	72.16	---	69.90	28.59	
June 2000	average	0.00	9.20	9.20	0.00	59.03	64.07	W(2), SI(2)
	cv (%)	---	61.97	61.97	---	43.52	36.68	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Four cracks evaluated.

Table I6: Full-Width Transverse Cracks for Crafco 299, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	1.98	0.00	1.98	0.00	7.81	9.79	W(2), SI(2)
	cv (%)	107.71	---	107.71	---	89.79	72.40	
May 1999	average	0.00	0.00	0.00	0.00	6.47	6.47	W(2), SI(2)
	cv (%)	---	---	---	---	105.56	105.56	
June 2000	average	0.00	0.00	0.00	0.00	8.85	8.85	W(2), SI(2)
	cv (%)	---	---	---	---	105.56	105.56	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table I7: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	3.19	0.00	3.19	0.00	8.85	12.04	B(1),W(2), SI(2)
	cv (%)	119.57	---	119.57	---	123.88	97.46	
May 1999	average	2.26	0.00	2.26	0.00	8.16	10.42	B(1),W(2), SI(2)
	cv (%)	172.89	---	172.89	---	124.65	98.85	
June 2000	average	2.56	0.00	2.04	0.00	14.06	16.10	B(1),W(2), SI(2)
	cv (%)	138.08	---	206.36	---	78.10	69.54	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Eight cracks evaluated.

Table I8: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
June 1998	average	3.82	0.00	3.82	0.00	3.30	7.12	B(1),W(2), SI(2)
	cv (%)	---	---	---	---	---	---	
May 1999	average	2.78	0.00	2.78	0.00	3.13	5.90	B(1),W(2), SI(2)
	cv (%)	---	---	---	---	---	---	
June 2000	average	3.13	0.00	1.04	0.00	7.99	9.03	B(1),W(2), SI(2)
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: One crack evaluated.
(a) no coefficient of variation for a single crack

Appendix J
Condition Survey Results for the Tarkio Site

Table J1: Full-Width Transverse Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.42	0.42	
	cv (%)	---	---	---	---	170.93	170.93	
March 1999	average	0.64	0.00	0.64	0.00	4.51	5.16	
	cv (%)	202.50	---	202.50	---	82.97	71.38	
August 1999	average	0.10	0.00	0.10	0.00	1.93	2.03	
	cv (%)	264.58	---	264.58	---	70.94	75.99	
September 2000	average	0.10	0.00	0.10	0.00	2.28	2.38	
	cv (%)	264.58	---	264.58	---	70.21	74.56	
July 2001	average	0.15	0.00	0.15	0.00	3.47	3.62	
	cv (%)	124.72	---	124.72	---	60.00	55.32	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Seven cracks were evaluated.

Table J2: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	5.56	17.01	
	cv (%)	---	---	---	---	---	---	
March 1999	average	0.00	0.00	0.00	0.00	28.82	28.82	
	cv (%)	---	---	---	---	---	---	
August 1999	average	11.46	0.00	11.46	0.00	5.56	5.56	
	cv (%)	---	---	---	---	---	---	
September 2000	average	13.19	0.00	13.19	0.00	6.25	19.44	
	cv (%)	---	---	---	---	---	---	
July 2001	average	3.47	0.00	3.47	0.00	45.49	48.96	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: One crack was evaluated.
(a) no coefficient of variation for a single crack

Table J3: Full-Width Transverse Cracks for Crafco 231, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
March 1999	average	0.00	43.63	43.63	0.00	0.00	43.63	
	cv (%)	---	32.52	32.52	---	---	32.52	
August 1999	average	0.00	3.24	3.24	0.00	0.00	3.24	
	cv (%)	---	173.21	173.21	---	---	173.21	
September 2000	average	0.00	3.13	3.13	0.00	0.00	3.13	
	cv (%)	---	173.21	173.21	---	---	173.21	
July 2001	average	0.00	10.88	10.88	0.00	2.78	13.66	
	cv (%)	---	58.96	58.96	---	106.80	28.58	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Three cracks were evaluated.

Table J4: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	1.65	1.65	
	cv (%)	---	---	---	---	141.42	141.42	
March 1999	average	0.00	0.00	0.00	0.00	5.56	5.56	
	cv (%)	---	---	---	---	8.84	8.84	
August 1999	average	0.87	0.00	0.87	0.00	1.91	2.78	
	cv (%)	141.42	---	141.42	---	141.42	141.42	
September 2000	average	1.56	0.00	1.56	0.00	1.74	3.30	
	cv (%)	141.42	---	141.42	---	141.42	141.42	
July 2001	average	1.39	0.00	1.39	0.00	5.82	7.20	
	cv (%)	141.42	---	141.42	---	2.11	25.56	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Two cracks were evaluated.

Table J5: Longitudinal Centerline Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	Material Failures (MF) CF (%)	Material Failures (MF) Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.68	0.68	
	cv (%)	---	---	---	---	---	---	
May 2001	average	4.17	0.00	4.17	0.00	27.38	31.55	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 14 ft.

Table J6: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	Material Failures (MF) CF (%)	Material Failures (MF) Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
August 1999	average	0.00	0.00	0.00	0.00	16.49	16.49	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	17.01	17.01	
	cv (%)	---	---	---	---	---	---	
May 2001	average	1.39	0.00	1.39	0.00	7.99	9.38	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 48 ft.

Table J7: Longitudinal Centerline Cracks for Crafco 231, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1999	average	0.00	0.00	0.00	0.00	0.23	0.23	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	0.23	0.23	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.00	0.12	0.21	0.00	1.04	1.16	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Three cracks were evaluated.

Table J8: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1999	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.00	0.00	0.00	0.00	1.88	1.88	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 31 ft.

Table J9: Longitudinal Centerline Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.11	0.11	
	cv (%)	---	---	---	---	---	---	
August 1999	average	0.00	0.00	0.00	0.00	7.00	7.00	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	7.33	7.33	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.00	0.00	0.00	0.00	11.33	11.33	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 75 ft.

Table J10: Full-Width Transverse Cracks for Crafco 522, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
March 1999	average	0.00	0.00	0.00	0.00	2.43	2.43	
	cv (%)	---	---	---	---	124.54	124.54	
August 1999	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
July 2001	average	0.00	0.00	0.00	0.00	0.26	0.26	
	cv (%)	---	---	---	---	200.00	200.00	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Four cracks were evaluated.

Table J11: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	1.04	1.04	
	cv (%)	---	---	---	---	141.42	141.42	
March 1999	average	1.62	0.00	1.62	0.00	12.19	13.81	
	cv (%)	173.21	---	173.21	---	73.86	66.91	
August 1999	average	0.00	0.00	0.00	0.00	11.09	11.09	
	cv (%)	---	---	---	---	112.47	112.47	
September 2000	average	4.02	0.00	4.02	0.00	5.06	9.08	
	cv (%)	26.91	---	26.91	---	103.59	63.32	
July 2001	average	3.67	0.00	3.67	0.00	15.59	19.26	
	cv (%)	71.05	---	71.05	---	154.48	134.06	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Two cracks were evaluated.

Table J12: Full-Width Transverse Cracks for Crafco 522, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
March 1999	average	0.00	18.19	18.19	2.50	0.00	20.69	
	cv (%)	---	65.67	65.67	140.06	---	53.25	
August 1999	average	0.00	0.00	0.00	1.04	0.00	1.04	
	cv (%)	---	---	---	223.61	---	223.61	
September 2000	average	0.00	0.21	0.21	1.11	0.00	1.32	
	cv (%)	---	149.07	149.07	223.61	---	180.80	
July 2001	average	0.07	3.19	3.26	1.11	0.76	5.14	
	cv (%)	223.61	87.77	83.63	223.61	223.61	60.07	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Five cracks were evaluated.

Table J13: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
March 1999	average	0.00	0.00	0.00	0.00	2.26	2.26	
	cv (%)	---	---	---	---	106.96	106.96	
August 1999	average	0.35	0.00	0.35	0.00	0.00	0.35	
	cv (%)	200.00	---	200.00	---	---	200.00	
September 2000	average	0.26	0.00	0.26	0.00	0.00	0.26	
	cv (%)	200.00	---	200.00	---	---	200.00	
July 2001	average	0.26	0.00	0.26	0.00	0.26	0.52	
	cv (%)	200.00	---	200.00	---	200.00	115.47	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Four cracks were evaluated.

Table J14: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
March 1999	average	0.00	0.00	0.00	0.00	0.69	0.69	
	cv (%)	---	---	---	---	---	---	
August 1999	average	0.00	0.00	0.00	0.00	1.04	1.04	
	cv (%)	---	---	---	---	---	---	
September 2000	average	1.74	0.00	1.74	0.00	0.00	1.74	
	cv (%)	---	---	---	---	---	---	
July 2001	average	0.00	0.00	0.00	0.00	0.35	0.35	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: One crack was evaluated.

Table J15: Longitudinal Centerline Cracks for Crafco 522, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1999	average	0.00	0.00	0.00	0.00	3.89	3.89	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	4.22	4.22	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.89	0.00	0.89	0.00	2.00	2.89	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table J16: Longitudinal Centerline Cracks for Crafco 522, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.03	0.03	
	cv (%)	---	---	---	---	---	---	
August 1999	average	17.97	0.00	17.97	0.00	17.64	35.61	
	cv (%)	---	---	---	---	---	---	
September 2000	average	20.02	0.00	20.02	0.00	14.83	34.85	
	cv (%)	---	---	---	---	---	---	
May 2001	average	25.00	0.00	16.99	0.00	21.97	37.01	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 77 ft.

Table J17: Longitudinal Centerline Cracks for Crafco 522, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1999	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.00	0.08	0.08	0.00	0.00	0.08	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table J18: Longitudinal Centerline Cracks for Crafco 522, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1999	average	0.00	0.00	0.00	5.73	1.59	7.32	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	5.73	1.78	7.51	
	cv (%)	---	---	---	---	---	---	
May 2001	average	6.23	0.00	6.23	0.00	0.38	6.62	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 131 ft.

Table J19: Longitudinal Centerline Cracks for Crafco 522, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1999	average	0.00	0.00	0.00	0.00	3.63	3.63	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	3.81	3.81	
	cv (%)	---	---	---	---	---	---	
May 2001	average	2.57	0.00	2.57	0.00	1.86	4.43	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 94 ft.

Table J20: Full-Width Transverse Cracks for Maxwell 72, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1998	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
March 1999	average	0.23	0.00	0.23	0.00	2.26	2.49	
	cv (%)	173.21	---	173.21	---	96.38	73.28	
August 1999	average	1.04	0.00	1.04	0.00	0.23	1.27	
	cv (%)	145.30	---	145.30	---	173.21	103.25	
September 2000	average	1.50	0.00	1.50	0.00	0.35	1.85	
	cv (%)	135.22	---	135.22	---	173.21	92.49	
July 2001	average	0.46	0.00	0.46	0.00	1.04	1.50	
	cv (%)	86.60	---	86.60	---	173.21	135.22	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Three cracks were evaluated.

Table J21: Full-Width Transverse Cracks for Maxwell 72, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	1.39	1.39	
	cv (%)	---	---	---	---	141.42	141.42	
March 1999	average	5.38	0.00	5.38	0.00	9.38	14.76	
	cv (%)	141.42	---	141.42	---	26.19	34.94	
August 1999	average	18.92	0.00	18.92	0.00	4.34	23.26	
	cv (%)	45.41	---	45.41	---	39.60	44.33	
September 2000	average	20.83	0.00	20.83	0.00	6.60	27.43	
	cv (%)	40.07	---	40.07	---	0.00	30.43	
July 2001	average	10.07	0.00	10.07	0.00	32.99	43.06	
	cv (%)	43.89	---	43.89	---	22.33	27.37	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Two cracks were evaluated.

Table J22: Longitudinal Centerline Cracks for Maxwell 72, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
August 1998	average	0.00	0.00	0.00	0.00	0.06	0.06	
	cv (%)	---	---	---	---	---	---	
August 1999	average	0.00	0.00	0.00	0.00	1.05	1.05	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	1.15	1.15	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.54	0.00	0.54	0.00	3.82	4.37	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 231 ft.

Table J23: Longitudinal Centerline Cracks for Maxwell 72, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1998	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
August 1999	average	1.67	0.00	1.67	0.00	1.78	3.44	
	cv (%)	---	---	---	---	---	---	
September 2000	average	1.89	0.00	1.89	0.00	1.86	3.75	
	cv (%)	---	---	---	---	---	---	
May 2001	average	0.11	0.00	0.11	0.00	25.67	25.78	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Longitudinal crack evaluations total 300 ft.

Table J24: Full-Width Transverse Cracks for Crafco 221, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
August 1998	average	0.00	0.00	0.00	0.00	5.21	5.21	
	cv (%)	---	---	---	---	---	---	
March 1999	average	15.28	0.00	15.28	0.00	6.25	21.53	
	cv (%)	---	---	---	---	---	---	
August 1999	average	9.72	0.00	9.72	0.00	2.78	12.50	
	cv (%)	---	---	---	---	---	---	
September 2000	average	12.15	0.00	12.15	0.00	3.47	15.63	
	cv (%)	---	---	---	---	---	---	
July 2001	average	27.08	0.00	27.08	0.00	15.97	43.06	
	cv (%)	---	---	---	---	---	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: One crack was evaluated.
(a) no coefficient of variation for a single crack

Table J25: Full-Width Transverse Cracks for Crafco 221, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
March 1999	average	0.00	34.72	34.72	0.00	0.00	34.72	
	cv (%)	---	32.53	32.53	---	---	32.53	
August 1999	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
September 2000	average	0.00	0.00	0.00	0.00	0.00	0.00	
	cv (%)	---	---	---	---	---	---	
July 2001	average	0.00	36.28	36.28	0.69	5.38	42.36	
	cv (%)	---	76.46	76.46	141.42	41.06	68.39	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Two cracks were evaluated.

Table J26: Full-Width Transverse Cracks for Crafco 221, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
March 1999	average	0.00	0.00	0.00	0.00	0.69	0.69	
	cv (%)	---	---	---	---	141.42	141.42	
August 1999	average	0.69	0.00	0.69	0.00	0.00	0.69	
	cv (%)	141.42	---	141.42	---	141.42	141.42	
September 2000	average	1.22	0.00	1.22	0.00	0.00	1.22	
	cv (%)	101.02	---	101.02	---	---	101.02	
July 2001	average	0.00	0.52	0.52	0.00	0.00	0.52	
	cv (%)	---	141.42	141.42	---	---	141.42	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Two cracks were evaluated.

Appendix K
Condition Survey Results for the Helena Site

Table K1: Full-Width Transverse Cracks for Deery 101 ELT, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.68	0.68	
	C.V. (%)	---	---	---	---	229.00	229.00	
February 1999	Mean	0.06	0.00	0.06	0.00	4.86	4.92	
	C.V. (%)	346.41	---	346.41	---	70.76	69.92	
July 1999	Mean	0.20	0.00	0.20	0.00	2.60	2.81	
	C.V. (%)	346.41	---	346.41	---	85.19	79.91	
August 2000	Mean	0.00	0.00	0.00	0.00	4.34	4.34	
	C.V. (%)	---	---	---	---	85.11	85.11	
April 2001	Mean	130.22	5.76	66.51	0.00	11.10	77.60	
	C.V. (%)	23.59	52.72	30.12	---	145.44	17.43	
September 2001	Mean	3.96	0.17	3.21	0.00	4.46	7.67	
	C.V. (%)	85.53	248.63	89.04	---	74.95	52.79	
February 2002	Mean	128.2	0.3	64.6	0.00	7.20	71.7	
	C.V. (%)	24.37	346.41	23.08	---	62.25	18.91	
August 2002	Mean	58.6	0.00	33.00	0.00	4.50	37.50	
	C.V. (%)	30.43	---	25.20	---	86.05	24.25	
May 2003	Mean	123.81	0.00	63.77	0.00	4.54	64.67	
	C.V. (%)	14.57	---	14.80	---	91.34	12.15	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K2: Full-Width Transverse Cracks for Deery 101 ELT, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.26	0.26	
	C.V. (%)	---	---	---	---	233.55	233.55	
February 1999	Mean	0.00	0.00	0.00	0.00	2.52	2.52	
	C.V. (%)	---	---	---	---	99.70	99.70	
July 1999	Mean	0.00	0.00	0.00	0.00	2.01	2.01	
	C.V. (%)	---	---	---	---	116.61	116.61	
August 2000	Mean	0.14	0.00	0.14	0.00	1.97	2.11	
	C.V. (%)	239.09	---	239.09	---	113.70	108.92	
April 2001	Mean	4.20	42.71	46.24	0.00	3.41	49.65	
	C.V. (%)	95.24	37.52	30.15	---	88.96	25.93	
September 2001	Mean	1.22	2.75	3.96	0.00	2.58	6.54	
	C.V. (%)	147.46	101.26	76.22	---	122.43	69.34	
February 2002	Mean	120.7	7.5	70.7	0.00	7.40	78.00	
	C.V. (%)	30.63	319.21	41.72	---	57.81	35.19	
August 2002	Mean	7.58	3.41	8.54	0.00	2.37	10.91	
	C.V. (%)	65.33	111.47	50.97	---	149.35	52.63	
May 2003	Mean	63.60	19.97	54.60	0.00	4.72	59.32	
	C.V. (%)	27.28	83.14	27.44	---	177.01	24.35	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K3: Full-Width Transverse Cracks for Deery 101 ELT, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.06	0.06	
	C.V. (%)	---	---	---	---	346.41	346.41	
February 1999	Mean	0.27	0.00	0.27	0.00	4.04	4.31	
	C.V. (%)	346.41	---	346.41	---	81.28	80.55	
July 1999	Mean	0.27	0.00	0.27	0.00	2.08	2.36	
	C.V. (%)	243.06	---	243.06	---	90.73	92.35	
August 2000	Mean	0.32	0.00	0.32	0.00	2.43	2.75	
	C.V. (%)	346.41	---	346.41	---	114.12	100.97	
April 2001	Mean	73.41	0.00	35.71	0.00	24.33	60.04	
	C.V. (%)	46.06	---	100.23	---	114.81	15.68	
September 2001	Mean	2.11	0.32	2.05	0.00	3.94	5.99	
	C.V. (%)	132.15	346.41	102.04	---	81.16	40.25	
February 2002	Mean	100.95	0.00	53.85	0.00	7.55	61.40	
	C.V. (%)	35.35	---	33.62	---	44.58	26.45	
August 2002	Mean	5.67	0.00	4.51	0.00	4.17	8.68	
	C.V. (%)	71.27	---	57.66	---	74.62	43.42	
May 2003	Mean	95.92	0.12	51.42	0.00	5.30	56.11	
	C.V. (%)	22.88	346.41	22.50	---	80.12	18.13	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K4: Full-Width Transverse Cracks for Deery 101 ELT, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	6.19	6.19	
	C.V. (%)	---	---	---	---	60.93	60.93	
February 1999	Mean	3.43	0.00	3.43	0.00	18.66	22.09	
	C.V. (%)	102.59	---	102.59	---	36.14	25.76	
July 1999	Mean	1.88	0.00	1.77	0.00	18.00	19.76	
	C.V. (%)	143.53	---	132.49	---	36.96	38.50	
August 2000	Mean	17.71	0.00	17.59	0.00	18.29	35.88	
	C.V. (%)	45.91	---	45.84	---	40.32	18.27	
April 2001	Mean	95.95	0.09	52.03	0.00	23.61	75.64	
	C.V. (%)	28.92	346.41	22.63	---	40.05	13.26	
September 2001	Mean	10.13	0.17	10.30	0.00	23.47	33.77	
	C.V. (%)	70.94	248.63	70.21	---	39.21	32.07	
February 2002	Mean	43.32	0.32	34.09	0.00	32.3	66.38	
	C.V. (%)	52.60	182.89	45.37	---	36.96	17.32	
August 2002	Mean	4.95	0.17	4.89	0.00	22.42	27.17	
	C.V. (%)	76.12	346.41	69.14	---	39.89	28.60	
May 2003	Mean	38.08	0.29	36.69	0.00	21.41	57.96	
	C.V. (%)	28.49	346.41	30.23	---	42.87	18.05	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K5: Full-Width Transverse Cracks for Deery 101 ELT, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.00	0.00	
	C.V. (%)	---	---	---	---	---	---	
February 1999	Mean	0.00	56.05	56.05	0.00	0.00	56.05	
	C.V. (%)	---	55.25	55.25	---	---	55.25	
July 1999	Mean	0.00	0.64	0.64	0.00	1.10	1.74	
	C.V. (%)	---	129.15	129.15	---	158.09	113.78	
August 2000	Mean	0.00	0.64	0.64	0.00	1.10	1.74	
	C.V. (%)	---	172.23	172.23	---	176.00	109.88	
April 2001	Mean	0.00	93.23	93.23	3.85	2.05	99.13	
	C.V. (%)	---	3.51	3.51	78.79	98.93	2.18	
September 2001	Mean	0.00	1.94	1.94	0.00	1.88	3.82	B(1), WR(1)
	C.V. (%)	---	130.16	130.16	---	113.93	87.02	
February 2002	Mean	0.00	96.99	96.99	4.60	1.33	98.03	B(1), WR(2)
	C.V. (%)	---	6.82	6.82	106.64	98.76	8.65	
August 2002	Mean	0.00	0.95	0.95	3.50	3.04	7.49	B(2), WR(2)
	C.V. (%)	---	260.90	260.90	114.45	77.68	74.14	
May 2003	Mean	0.00	58.98	58.98	0.84	0.23	59.82	WR(2)
	C.V. (%)	---	35.58	35.58	195.25	266.29	35.79	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K6: Full-Width Transverse Cracks for Crafco 231, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO (%)	SC (%)	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)				
July 1998	Mean	0.00	0.00	0.00	0.00	3.88	3.88	
	C.V. (%)	---	---	---	---	67.30	67.30	
February 1999	Mean	0.00	0.00	0.00	0.00	6.64	6.64	
	C.V. (%)	---	---	---	---	58.03	58.03	
July 1999	Mean	0.17	0.00	0.17	0.00	6.45	6.63	
	C.V. (%)	346.41	---	346.41	---	66.91	64.04	
August 2000	Mean	0.09	0.00	0.09	0.00	5.87	5.96	
	C.V. (%)	346.41	---	346.41	---	79.93	78.70	
April 2001	Mean	1.37	0.00	1.37	0.00	8.15	9.52	
	C.V. (%)	96.12	---	96.12	---	48.40	50.58	
September 2001	Mean	3.96	0.00	3.96	0.00	6.05	10.01	
	C.V. (%)	74.65	---	74.65	---	58.22	42.50	
May 2002	Mean	1.97	0.00	1.97	0.00	9.20	11.17	
	C.V. (%)	104.63	---	104.63	---	54.51	51.15	
August 2002	Mean	0.52	0.00	0.52	0.00	6.83	7.35	
	C.V. (%)	131.81	---	131.81	---	62.40	59.99	
May 2003	Mean	0.12	0.00	0.12	0.00	8.04	8.16	
	C.V. (%)	266.29	---	266.29	---	61.89	60.71	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K7: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	Material Failures (MF) CF (%)	Material Failures (MF) Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.09	0.09	
	C.V. (%)	---	---	---	---	346.41	346.41	
February 1999	Mean	0.06	0.00	0.06	0.00	2.95	3.01	
	C.V. (%)	346.41	---	346.61	---	204.48	199.63	
July 1999	Mean	0.29	0.00	0.29	0.00	0.81	1.10	
	C.V. (%)	197.07	---	197.07	---	93.78	107.58	
August 2000	Mean	0.20	0.00	0.20	0.00	2.26	2.46	
	C.V. (%)	346.41	---	346.41	---	238.92	217.33	
April 2001	Mean	1.13	0.06	1.19	0.00	4.34	5.53	
	C.V. (%)	182.80	346.61	174.48	---	165.73	137.27	
September 2001	Mean	4.02	0.00	4.02	0.00	2.58	6.60	
	C.V. (%)	82.52	---	82.52	---	260.15	93.43	
May 2002	Mean	0.75	0.52	1.27	0.00	7.41	8.68	WR(2)
	C.V. (%)	96.08	222.93	125.43	---	87.20	78.70	
August 2002	Mean	0.14	0.00	0.14	0.00	2.58	2.72	WR(2)
	C.V. (%)	346.41	---	346.41	---	231.58	219.22	
May 2003	Mean	0.23	0.14	0.38	0.00	3.96	4.34	WR(3)
	C.V. (%)	205.60	346.41	169.10	---	195.73	177.50	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K8: Full-Width Transverse Cracks for Crafco 231, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.00	0.00	
	C.V. (%)	---	---	---	---	---	---	
February 1999	Mean	0.00	1.56	1.56	0.00	2.00	3.56	
	C.V. (%)	---	199.55	199.55	---	149.26	96.50	
July 1999	Mean	0.00	0.17	0.17	0.00	1.16	1.33	
	C.V. (%)	---	248.63	248.63	---	219.83	198.93	
August 2000	Mean	0.00	0.33	0.33	0.23	1.50	2.07	
	C.V. (%)	---	300.51	300.51	346.41	161.19	115.42	
April 2001	Mean	0.00	33.93	33.93	0.77	3.24	37.93	
	C.V. (%)	---	48.40	48.40	159.65	94.55	40.82	
September 2001	Mean	0.00	0.14	0.14	0.61	2.40	3.15	
	C.V. (%)	---	346.41	346.41	204.04	111.56	75.18	
May 2002	Mean	0.00	64.84	64.84	1.10	3.76	69.59	WR(2)
	C.V. (%)	---	42.91	42.91	157.51	184.23	40.02	
August 2002	Mean	0.00	9.09	9.09	1.74	4.25	15.08	WR(2)
	C.V. (%)	---	70.46	70.46	123.88	153.64	57.83	
May 2003	Mean	0.00	43.65	43.65	1.82	3.07	48.54	WR(3)
	C.V. (%)	---	23.75	23.75	114.32	228.15	15.37	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K9: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	1.94	1.94	
	C.V. (%)	---	---	---	---	85.97	85.97	
February 1999	Mean	0.00	0.00	0.00	0.00	10.75	10.75	
	C.V. (%)	---	---	---	---	48.38	48.38	
July 1999	Mean	0.67	0.00	0.67	0.00	8.88	9.55	
	C.V. (%)	159.59	---	159.59	---	46.50	43.43	
August 2000	Mean	0.00	0.00	0.00	0.00	6.77	6.77	
	C.V. (%)	---	---	---	---	55.73	55.73	
April 2001	Mean	0.43	0.00	0.43	0.00	12.60	13.04	
	C.V. (%)	153.03	---	153.03	---	49.84	48.73	
September 2001	Mean	2.08	0.00	2.00	0.00	7.55	9.55	
	C.V. (%)	113.93	---	110.52	---	46.81	40.12	
May 2002	Mean	0.52	0.00	0.43	0.00	10.19	10.62	
	C.V. (%)	169.37	---	202.17	---	54.07	52.18	
August 2002	Mean	7.32	0.00	4.28	0.00	10.30	14.50	
	C.V. (%)	115.16	---	110.27	---	51.55	41.34	
May 2003	Mean	0.67	0.00	0.67	0.00	11.52	12.12	
	C.V. (%)	162.66	---	162.66	---	45.43	46.19	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K10: Full-Width Transverse Cracks for Crafco 231, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	4.40	4.40	
	C.V. (%)	---	---	---	---	55.88	55.88	
February 1999	Mean	0.00	0.00	0.00	0.00	16.46	16.46	
	C.V. (%)	---	---	---	---	47.35	47.35	
July 1999	Mean	0.00	0.00	0.00	0.00	14.58	14.58	
	C.V. (%)	---	---	---	---	42.93	42.93	
August 2000	Mean	0.46	0.00	0.46	0.00	15.25	15.71	
	C.V. (%)	184.64	---	184.64	---	46.32	45.60	
April 2001	Mean	0.49	0.00	0.49	0.00	21.20	21.69	
	C.V. (%)	174.10	---	174.10	---	35.50	33.21	
September 2001	Mean	2.89	0.00	2.60	0.00	13.72	16.00	
	C.V. (%)	77.15	---	87.64	---	47.85	48.60	
May 2002	Mean	3.39	0.00	2.34	0.00	26.74	29.08	
	C.V. (%)	77.26	---	192.66	---	58.49	44.49	
August 2002	Mean	0.09	0.00	0.09	0.00	18.03	17.22	
	C.V. (%)	346.41	---	346.41	---	45.76	36.61	
May 2003	Mean	5.06	0.00	5.06	0.00	23.44	27.52	
	C.V. (%)	67.91	---	67.91	---	37.27	30.14	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K11: Full-Width Transverse Cracks for Maxwell 72, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	2.05	2.05	
	C.V. (%)	---	---	---	---	90.29	9.29	
February 1999	Mean	0.10	0.00	0.10	0.00	14.37	14.47	
	C.V. (%)	346.41	---	346.41	---	31.95	32.17	
July 1999	Mean	0.00	0.00	0.00	0.00	5.31	5.31	
	C.V. (%)	---	---	---	---	37.37	37.37	
August 2000	Mean	0.00	0.00	0.00	0.00	5.35	5.35	
	C.V. (%)	---	---	---	---	68.67	68.67	
April 2001	Mean	101.42	0.14	55.50	0.00	29.21	84.71	
	C.V. (%)	31.45	239.09	52.93	---	115.64	10.45	
September 2001	Mean	6.28	0.00	6.05	0.00	11.52	17.56	
	C.V. (%)	69.53	---	71.31	---	43.95	36.86	
February 2002	Mean	2.30	0.10	2.30	0.00	16.9	19.3	
	C.V. (%)	126.09	346.41	128.29	---	39.12	36.50	
August 2002	Mean	0.00	0.00	0.00	0.00	11.26	11.26	WR(3)
	C.V. (%)	---	---	---	---	47.31	47.31	
May 2003	Mean	0.78	0.00	0.58	0.00	11.75	12.33	WR(3)
	C.V. (%)	204.22	---	192.02	---	48.40	49.40	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K12: Full-Width Transverse Cracks for Maxwell 72, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.48	0.48	
	C.V. (%)	---	---	---	---	173.44	173.44	
February 1999	Mean	0.00	0.00	0.00	0.00	4.44	4.44	
	C.V. (%)	---	---	346.41	---	137.09	137.09	
July 1999	Mean	0.00	0.00	0.00	0.00	3.33	3.33	
	C.V. (%)	---	---	---	---	174.75	174.75	
August 2000	Mean	0.00	0.00	0.00	0.00	3.65	3.65	
	C.V. (%)	---	---	---	---	169.18	169.18	
April 2001	Mean	0.75	0.00	0.75	0.00	5.73	6.48	
	C.V. (%)	116.15	---	116.15	---	139.78	122.32	
September 2001	Mean	0.00	0.00	0.00	0.00	4.40	4.40	
	C.V. (%)	---	---	---	---	155.41	155.41	
May 2002	Mean	0.12	0.00	0.12	0.00	7.06	7.18	
	C.V. (%)	233.55	---	233.55	---	133.11	129.83	
August 2002	Mean	0.00	0.00	0.00	0.00	6.19	6.19	
	C.V. (%)	---	---	---	---	119.38	119.38	
May 2003	Mean	0.06	0.00	0.06	0.00	4.86	4.92	
	C.V. (%)	233.55	---	233.55	---	131.32	129.10	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K13: Full-Width Transverse Cracks for Maxwell 72, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.00	0.00	
	C.V. (%)	---	---	---	---	173.44	---	
February 1999	Mean	0.00	46.01	46.01	0.00	3.41	49.42	
	C.V. (%)	---	57.73	57.73	---	95.80	51.68	
July 1999	Mean	0.00	1.65	1.65	0.00	1.90	3.54	
	C.V. (%)	---	166.77	166.77	---	149.63	102.39	
August 2000	Mean	0.00	1.53	1.53	0.00	2.52	4.05	
	C.V. (%)	---	116.44	116.44	---	110.83	68.51	
April 2001	Mean	0.00	90.48	90.48	0.00	4.83	95.31	
	C.V. (%)	---	7.79	7.79	---	79.81	5.62	
September 2001	Mean	0.00	35.79	35.79	0.00	5.67	41.46	
	C.V. (%)	---	32.23	32.35	---	80.65	30.55	
May 2002	Mean	0.00	98.4	98.4	0.00	3.10	99.0	WR(2)
	C.V. (%)	---	2.08	2.08	---	153.51	1.77	
August 2002	Mean	0.00	54.92	54.92	0.00	5.30	60.22	WR(3)
	C.V. (%)	---	34.56	34.56	---	67.35	30.02	
May 2003	Mean	0.00	97.67	97.67	0.00	2.26	97.93	WR(3)
	C.V. (%)	---	2.28	2.28	---	171.50	3.75	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K14: Full-Width Transverse Cracks for Maxwell 72, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	2.21	2.21	
	C.V. (%)	---	---	---	---	138.10	138.10	
February 1999	Mean	5.15	0.00	5.15	0.00	15.25	20.40	
	C.V. (%)	74.68	---	74.68	---	39.55	32.69	
July 1999	Mean	0.49	0.00	0.49	0.00	13.66	14.15	
	C.V. (%)	346.41	---	346.41	---	41.40	43.41	
August 2000	Mean	3.53	0.00	3.53	0.00	14.06	17.59	
	C.V. (%)	63.03	---	63.03	---	52.29	48.36	
April 2001	Mean	27.20	0.00	24.83	0.00	25.77	50.59	
	C.V. (%)	29.35	---	25.21	---	31.66	20.06	
September 2001	Mean	6.51	0.00	6.51	0.00	29.17	35.68	
	C.V. (%)	56.31	---	56.31	---	37.15	26.55	
May 2002	Mean	14.67	0.00	14.67	0.00	36.00	50.67	
	C.V. (%)	27.77	---	27.77	---	32.74	22.93	
August 2002	Mean	0.00	0.00	0.00	0.00	16.61	16.61	
	C.V. (%)	---	---	---	---	39.50	39.50	
May 2003	Mean	29.05	0.00	27.89	0.00	17.77	45.66	
	C.V. (%)	30.97	---	29.23	---	44.30	22.83	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K15: Full-Width Transverse Cracks for Maxwell 72, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	2.36	2.36	
	C.V. (%)	---	---	---	---	75.83	75.83	
February 1999	Mean	0.00	0.00	0.00	0.00	7.32	7.32	
	C.V. (%)	---	---	---	---	53.26	53.26	
July 1999	Mean	0.00	0.00	0.00	0.00	4.43	4.43	
	C.V. (%)	---	---	---	---	70.95	70.95	
August 2000	Mean	0.00	0.00	0.00	0.00	4.28	4.28	
	C.V. (%)	---	---	---	---	53.71	53.71	
April 2001	Mean	2.31	0.00	2.08	0.00	10.60	12.69	
	C.V. (%)	69.58	---	61.55	---	31.69	30.72	
September 2001	Mean	0.43	0.00	0.43	0.00	6.77	7.20	
	C.V. (%)	202.17	---	202.17	---	50.70	47.54	
May 2002	Mean	10.0	0.00	6.00	0.00	13.0	19.0	
	C.V. (%)	102.57	---	85.17	---	52.36	34.50	
August 2002	Mean	0.26	0.00	0.26	0.00	7.58	7.70	
	C.V. (%)	273.40	---	273.40	---	54.57	52.71	
May 2003	Mean	1.24	0.00	1.24	0.00	9.11	10.36	
	C.V. (%)	141.53	---	141.53	---	39.09	33.30	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K16: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	3.52	3.52	
	C.V. (%)	---	---	---	---	86.54	86.54	
February 1999	Mean	0.00	0.00	0.00	0.00	9.17	9.17	
	C.V. (%)	---	---	---	---	47.98	47.98	
July 1999	Mean	0.00	0.00	0.00	0.00	6.11	6.11	
	C.V. (%)	---	---	---	---	77.66	77.66	
August 2000	Mean	0.00	0.00	0.00	0.00	5.44	5.44	
	C.V. (%)	---	---	---	---	92.75	92.75	
April 2001	Mean	0.12	0.00	0.12	0.00	10.04	10.16	
	C.V. (%)	266.29	---	266.29	---	48.74	49.87	
September 2001	Mean	0.00	0.00	0.00	0.00	8.25	8.25	
	C.V. (%)	---	---	---	---	64.98	64.98	
February 2002	Mean	0.17	0.00	0.09	0.00	11.40	11.49	
	C.V. (%)	346.41	---	346.41	---	58.94	58.73	
August 2002	Mean	0.00	0.00	0.00	0.00	9.52	9.52	
	C.V. (%)	---	---	---	---	60.30	60.30	
May 2003	Mean	0.35	0.00	0.35	0.00	11.11	11.46	
	C.V. (%)	221.56	---	221.56	---	51.83	55.68	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K17: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	4.75	4.75	
	C.V. (%)	---	---	---	---	75.26	75.26	
February 1999	Mean	0.00	0.00	0.00	0.00	16.44	16.44	
	C.V. (%)	---	---	---	---	46.45	46.45	
July 1999	Mean	0.00	0.00	0.00	0.00	14.41	14.41	
	C.V. (%)	---	---	---	---	47.97	47.97	
August 2000	Mean	0.00	0.00	0.00	0.00	12.18	12.18	
	C.V. (%)	---	---	---	---	61.66	61.66	
April 2001	Mean	2.49	0.00	2.40	0.00	21.56	23.96	
	C.V. (%)	74.27	---	74.35	---	32.76	30.97	
September 2001	Mean	0.00	0.00	0.00	0.00	18.81	18.81	
	C.V. (%)	---	---	---	---	45.54	45.54	
February 2002	Mean	2.14	0.00	1.33	0.00	24.02	25.35	
	C.V. (%)	113.37	---	174.41	---	38.92	36.17	
August 2002	Mean	0.00	0.00	0.00	0.00	20.08	19.99	
	C.V. (%)	---	---	---	---	53.13	52.79	
May 2003	Mean	1.10	0.00	1.10	0.00	29.20	30.30	
	C.V. (%)	108.42	---	108.42	---	55.87	53.18	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K18: Full-Width Transverse Cracks for Crafco 522, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.61	0.61	
	C.V. (%)	---	---	---	---	170.78	170.78	
February 1999	Mean	0.00	0.00	0.00	0.00	4.28	4.28	
	C.V. (%)	---	---	---	---	61.97	61.97	
July 1999	Mean	0.00	0.00	0.00	0.00	2.81	2.81	
	C.V. (%)	---	---	---	---	90.37	90.37	
August 2000	Mean	0.00	0.00	0.00	0.00	2.31	2.31	
	C.V. (%)	---	---	---	---	83.96	83.96	
April 2001	Mean	0.58	0.00	0.58	0.00	5.93	6.51	
	C.V. (%)	186.84	---	186.84	---	54.25	48.78	
September 2001	Mean	0.00	0.00	0.00	0.00	3.41	3.41	
	C.V. (%)	---	---	---	---	78.99	78.99	
February 2002	Mean	0.00	0.06	0.06	0.00	6.60	6.66	
	C.V. (%)	---	346.41	346.41	---	37.62	36.61	
August 2002	Mean	0.00	0.00	0.00	0.00	5.47	5.47	
	C.V. (%)	---	---	---	---	65.38	65.38	
May 2003	Mean	0.17	0.06	0.23	0.00	6.68	6.92	WR(2)
	C.V. (%)	233.55	346.41	184.64	---	52.84	52.16	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K19: Full-Width Transverse Cracks for Crafco 522, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.03	0.03	
	C.V. (%)	---	---	---	---	346.41	346.41	
February 1999	Mean	0.00	1.13	1.13	0.00	3.39	4.51	
	C.V. (%)	---	173.62	173.62	---	64.00	30.94	
July 1999	Mean	0.00	0.00	0.00	0.00	1.04	1.04	
	C.V. (%)	---	---	---	---	109.18	109.18	
August 2000	Mean	0.00	0.09	0.09	0.00	2.00	2.08	
	C.V. (%)	---	346.41	346.41	---	100.90	98.73	
April 2001	Mean	0.00	14.64	14.64	0.00	4.31	18.95	
	C.V. (%)	---	52.85	52.85	---	59.13	45.22	
September 2001	Mean	0.00	0.58	0.58	0.00	3.67	4.25	
	C.V. (%)	---	181.51	181.51	---	86.46	78.08	
February 2002	Mean	0.00	21.38	21.38	0.00	4.83	26.22	
	C.V. (%)	---	53.88	53.88	---	95.20	50.45	
August 2002	Mean	0.00	6.71	6.71	0.00	5.44	12.15	
	C.V. (%)	---	91.74	91.74	---	82.16	60.99	
May 2003	Mean	0.00	41.30	41.30	0.00	6.02	47.31	WR(2)
	C.V. (%)	---	41.28	41.28	---	79.35	29.23	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K20: Full-Width Transverse Cracks for Crafco 522, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	1.17	1.17	
	C.V. (%)	---	---	---	---	114.60	114.60	
February 1999	Mean	0.00	0.00	0.00	0.00	5.89	5.89	
	C.V. (%)	---	---	---	---	141.99	141.99	
July 1999	Mean	0.00	0.00	0.00	0.00	3.13	3.13	
	C.V. (%)	---	---	---	---	88.76	88.76	
August 2000	Mean	0.00	0.00	0.00	0.00	3.82	3.82	
	C.V. (%)	---	---	---	---	150.23	150.23	
April 2001	Mean	0.17	0.00	0.14	0.00	5.84	5.99	
	C.V. (%)	200.00	---	239.09	---	115.94	112.58	
September 2001	Mean	0.00	0.00	0.00	0.00	5.58	5.58	
	C.V. (%)	---	---	181.51	---	146.91	146.91	
February 2002	Mean	0.00	0.00	0.00	0.00	8.25	8.25	
	C.V. (%)	---	---	---	---	139.38	139.38	
August 2002	Mean	0.09	0.00	0.09	0.00	5.32	5.41	
	C.V. (%)	346.41	---	346.41	---	161.08	158.08	
May 2003	Mean	0.00	0.00	0.00	0.00	8.45	8.28	
	C.V. (%)	---	---	---	---	126.23	122.47	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K21: Full-Width Transverse Cracks for Maxwell 71, Square Reservoir and Recessed

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	8.15	8.15	
	C.V. (%)	---	---	---	---	58.03	58.03	
February 1999	Mean	3.99	0.00	3.99	0.00	12.18	16.17	
	C.V. (%)	110.40	---	110.40	---	60.39	49.24	
July 1999	Mean	5.64	0.00	5.64	0.00	11.83	17.48	
	C.V. (%)	54.74	---	54.74	---	49.67	26.10	
August 2000	Mean	4.80	0.00	4.80	0.00	11.46	16.26	
	C.V. (%)	75.49	---	75.49	---	59.14	50.52	
April 2001	Mean	42.88	0.00	38.98	0.00	22.79	61.76	
	C.V. (%)	31.05	---	31.45	---	38.52	19.66	
September 2001	Mean	6.16	0.00	6.16	0.09	9.95	16.20	
	C.V. (%)	63.84	---	63.84	346.41	65.81	34.52	
February 2002	Mean	43.40	0.00	41.03	0.00	14.87	55.90	
	C.V. (%)	36.92	---	38.85	---	54.22	30.33	
August 2002	Mean	1.74	6.39	8.13	0.00	15.80	23.93	WR(1)
	C.V. (%)	346.41	73.67	71.86	---	62.38	46.55	
May 2003	Mean	27.34	0.00	27.34	0.00	17.59	44.88	
	C.V. (%)	34.88	---	34.88	---	54.33	36.21	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K22: Full-Width Transverse Cracks for Maxwell 71, Square Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	3.78	3.78	
	C.V. (%)	---	---	---	---	81.66	81.66	
February 1999	Mean	0.06	0.00	0.06	0.00	10.65	10.17	
	C.V. (%)	346.41	---	346.41	---	64.88	64.89	
July 1999	Mean	0.00	0.00	0.00	0.00	7.15	7.15	
	C.V. (%)	---	---	---	---	64.13	64.13	
August 2000	Mean	0.00	0.00	0.00	0.00	5.87	5.87	
	C.V. (%)	---	---	---	---	74.02	74.02	
April 2001	Mean	1.97	0.03	1.91	0.00	14.06	15.97	
	C.V. (%)	122.11	346.41	126.09	---	46.04	34.61	
September 2001	Mean	0.00	0.00	0.00	0.00	6.02	6.02	
	C.V. (%)	---	---	---	---	74.26	74.26	
February 2002	Mean	9.90	0.00	5.96	0.00	13.48	19.44	
	C.V. (%)	102.58	---	85.17	---	51.23	38.35	
August 2002	Mean	0.00	0.06	0.06	0.00	7.44	7.49	
	C.V. (%)	---	346.41	346.41	---	70.80	69.33	
May 2003	Mean	30.50	3.36	22.45	0.00	11.43	33.88	
	C.V. (%)	63.93	121.55	44.15	---	55.78	34.34	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K23: Full-Width Transverse Cracks for Maxwell 71, Simple Band-Aid

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.46	0.46	
	C.V. (%)	---	---	---	---	195.40	195.40	
February 1999	Mean	0.00	25.72	25.72	0.00	6.97	32.70	
	C.V. (%)	---	56.07	56.07	---	64.38	44.35	
July 1999	Mean	0.00	0.90	0.90	0.00	4.31	5.21	
	C.V. (%)	---	197.7	197.70	---	74.96	62.47	
August 2000	Mean	0.00	3.79	3.79	0.00	3.82	7.61	
	C.V. (%)	---	74.47	74.47	---	83.14	49.70	
April 2001	Mean	0.00	93.23	93.23	0.58	6.02	99.83	
	C.V. (%)	---	4.72	4.72	195.40	72.24	0.60	
September 2001	Mean	0.00	23.93	23.93	0.46	10.68	35.07	
	C.V. (%)	---	46.69	46.69	252.49	54.40	26.47	
February 2002	Mean	0.00	99.42	99.42	0.35	6.92	99.42	
	C.V. (%)	---	2.02	2.02	346.41	61.17	5.55	
August 2002	Mean	0.00	38.57	38.57	0.90	7.96	47.42	W(2), WR(2)
	C.V. (%)	---	40.23	40.23	164.61	49.00	36.80	
May 2003	Mean	0.00	100.00	100.00	0.00	6.60	100.00	WR(3)
	C.V. (%)	---	---	---	---	68.51	---	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K24: Full-Width Transverse Cracks for Maxwell 71, Shallow Reservoir and Flush

Date of Evaluation	Statistic	Material Failures (MF) AF (%)	CF (%)	Total (%)	PO (%)	SC (%)	Total Failure	Superficial Distress
July 1998	Mean	0.00	0.00	0.00	0.00	0.42	0.42	
	C.V. (%)	---	---	---	---	159.25	159.25	
February 1999	Mean	0.00	0.00	0.00	0.00	4.63	4.63	
	C.V. (%)	---	---	---	---	69.87	69.87	
July 1999	Mean	0.00	0.00	0.00	0.00	2.50	2.50	
	C.V. (%)	---	---	---	---	104.55	104.55	
August 2000	Mean	0.00	0.00	0.00	0.00	1.85	1.85	
	C.V. (%)	---	---	---	---	91.62	91.62	
April 2001	Mean	0.38	0.00	0.38	0.00	6.48	6.86	
	C.V. (%)	186.53	---	186.53	---	91.04	88.15	
September 2001	Mean	0.00	0.00	0.00	0.00	2.26	2.26	
	C.V. (%)	---	---	---	---	132.75	132.75	
February 2002	Mean	0.23	0.00	0.23	0.00	6.25	6.48	
	C.V. (%)	242.15	---	242.15	---	94.84	97.35	
August 2002	Mean	0.12	0.00	0.12	0.00	2.89	3.01	
	C.V. (%)	233.55	---	233.55	---	123.05	118.73	
May 2003	Mean	0.00	14.15	14.15	0.00	5.01	19.16	
	C.V. (%)	---	64.91	64.91	---	74.03	47.77	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Table K25: Full-Width Transverse Cracks for Maxwell 71, Square Reservoir and Band-Aid

Date of Evaluation	Statistic	Material Failures (MF)			PO	SC	Total Failure	Superficial Distress
		AF (%)	CF (%)	Total (%)	(%)	(%)		
July 1998	Mean	0.00	0.00	0.00	0.00	0.32	0.32	
	C.V. (%)	---	---	---	---	170.65	170.65	
February 1999	Mean	0.00	0.00	0.00	0.00	5.96	5.96	
	C.V. (%)	---	---	---	---	96.29	96.29	
July 1999	Mean	0.00	0.00	0.00	0.00	1.77	1.77	
	C.V. (%)	---	---	---	---	134.92	134.92	
August 2000	Mean	0.00	0.00	0.00	0.00	1.42	1.42	
	C.V. (%)	---	---	---	---	134.73	134.73	
April 2001	Mean	0.14	0.00	0.14	0.00	11.49	11.63	
	C.V. (%)	279.48	---	279.48	---	63.29	61.80	
September 2001	Mean	0.00	0.00	0.00	0.00	2.40	2.40	
	C.V. (%)	---	---	---	---	98.92	98.92	
February 2002	Mean	55.61	0.00	30.06	0.00	8.74	38.80	
	C.V. (%)	27.37	---	26.83	---	65.09	26.20	
August 2002	Mean	0.06	0.00	0.06	0.00	3.76	3.82	WR(3)
	C.V. (%)	346.41	---	346.41	---	112.22	109.30	
May 2003	Mean	80.21	0.00	40.10	0.00	10.59	50.69	WR(3)
	C.V. (%)	18.66	---	18.66	---	59.88	18.39	

Total Material Failures (MF) = adhesion failures (AF) + cohesion failures (CF) – overlap (AF/CF)
Total Failure = MF + pullouts (PO) + secondary cracking (SC) – overlap (MF/PO/SC)
Note: Twelve cracks were evaluated.

Appendix L

Structural Condition Data for the Helena Site

Table L1: Pavement Structural Condition – Deery 101, Square Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [59, 62]*				
Average Peak FWD Load (kips), [# tests]	8.8 [7]	6.1 [7]	8.0 [7]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	993 [8.7]	1000 [9.5]	1030 [8.5]	1060 [8.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	318 [9.8]	336 [10]	344 [12]	363 [9.6]
Mean Base Modulus (ksi), [CV]	29.8 [13]	26.9 [22]	29.9 [19]	31.3 [18]
Subgrade Modulus (ksi), [CV]	11.2 [19]	12.3 [17]	11.7 [17]	12.3 [21]
April 21, 1999 [49, 66]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	5.9 [6]	7.5 [6]	10.2 [6]
Mean Pavement Stiffness (k/in.), [CV]	1070 [5.9]	1060 [7.8]	1080 [8.3]	1190 [18]
Mean Asphalt Concrete Modulus (ksi), [CV]	309 [12]	314 [18]	319 [16]	345 [25]
Mean Base Modulus (ksi), [CV]	33.4 [16]	29.8 [12]	33.5 [16]	41.8 [27]
Subgrade Modulus (ksi), [CV]	12.3 [20]	14.1 [9.1]	13.2 [18]	14.3 [29]
August 11, 1999 [63, 77]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	6.0 [4]	8.1 [4]	9.9 [4]
Mean Pavement Stiffness (k/in.), [CV]	1030 [7.7]	1010 [8.0]	1040 [8.1]	1060 [7.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	426 [15]	417 [7.7]	427 [11]	435 [7.5]
Mean Base Modulus (ksi), [CV]	31.9 [34]	33.1 [35]	35.7 [37]	39.0 [38]
Subgrade Modulus (ksi), [CV]	16.5 [20]	15.8 [8.7]	16.4 [21]	16.2 [22]
May 11, 2000 [45, 44]*				
Average Peak FWD Load (kips), [# tests]	8.8 [4]	5.9 [4]	7.9 [5]	9.7 [5]
Mean Pavement Stiffness (k/in.), [CV]	1290 [14]	1250 [14]	1290 [12]	1340 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	442 [13]	386 [17]	428 [11]	473 [13]
Mean Base Modulus (ksi), [CV]	25.1 [36]	30.8 [13]	28.5 [31]	26.8 [32]
Subgrade Modulus (ksi), [CV]	12.7 [9.3]	11.7 [15]	12.7 [19]	12.9 [13]
September 26, 2000 [46, 48]*				
Average Peak FWD Load (kips), [# tests]	9.4 [6]	6.3 [1]	8.4 [6]	10.3 [5]
Mean Pavement Stiffness (k/in.), [CV]	1300 [8.6]	1140 [na]	1320 [8.1]	1340 [6.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	479 [14]	486 [na]	486 [13]	500 [12]
Mean Base Modulus (ksi), [CV]	30.2 [19]	25.1 [na]	30.7 [19]	30.9 [20]
Subgrade Modulus (ksi), [CV]	14.2 [25]	10.6 [na]	14.6 [26]	14.9 [23]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L1: Pavement Structural Condition – Deery 101 Square Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [55, 45]*				
Average Peak FWD Load (kips), [# tests]	9.1 [6]	No data	8.2 [3]	10.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1170 [6.7]		1210 [12]	1220 [5.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	377 [9.5]		417 [24]	362 [14]
Mean Base Modulus (ksi), [CV]	19.7 [27]		29.8 [4.6]	33.3 [56]
Subgrade Modulus (ksi), [CV]	14.6 [20]		12.8 [17]	13.0 [34]
October 2, 2001 [35, 52]*				
Average Peak FWD Load (kips), [# tests]	9.9 [7]	6.7 [2]	9.0 [7]	11.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1280 [11]	1220 [7.9]	1320 [11]	1370 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	497 [12]	494 [14]	516 [13]	556 [12]
Mean Base Modulus (ksi), [CV]	30.7 [23]	34.8 [20]	31.3 [28]	30.6 [27]
Subgrade Modulus (ksi), [CV]	14.3 [16]	11.4 [22]	14.5 [14]	16.0 [14]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.7 [5]	No data	7.8 [4]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1340 [11]		1410 [10]	1380 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	541 [26]		627 [22]	568 [26]
Mean Base Modulus (ksi), [CV]	25.3 [19]		23.0 [14]	25.8 [20]
Subgrade Modulus (ksi), [CV]	16.4 [7.7]		16.4 [6.9]	17.4 [12]
September 4, 2002 [61, 65]*				
Average Peak FWD Load (kips), [# tests]	9.2 [7]	No data	8.1 [7]	10.2 [7]
Mean Pavement Stiffness (k/in.), [CV]	1210 [15]		1220 [17]	1240 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	444 [27]		469 [51]	487 [49]
Mean Base Modulus (ksi), [CV]	46.4 [13]		46.0 [37]	45.8 [38]
Subgrade Modulus (ksi), [CV]	12.1 [22]		12.8 [6.6]	13.7 [11]
May 13, 2003 [54, 49]*				
Average Peak FWD Load (kips), [# tests]	8.9 [7]	No data	8.0 [7]	10.2 [7]
Mean Pavement Stiffness (k/in.), [CV]	1440 [12]		1430 [12]	1470 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	624 [27]		616 [26]	642 [26]
Mean Base Modulus (ksi), [CV]	31.8 [26]		29.4 [30]	32.2 [27]
Subgrade Modulus (ksi), [CV]	13.6 [11]		14.0 [14]	14.2 [15]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L2: Pavement Structural Condition – Deery 101, Shallow Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [60, 65]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	6.1 [6]	8.0 [6]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1250 [17]	1270 [15]	1310 [15]	1360 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	429 [16]	434 [13]	443 [14]	467 [13]
Mean Base Modulus (ksi), [CV]	38.5 [26]	35.0 [22]	40.9 [23]	42.3 [21]
Subgrade Modulus (ksi), [CV]	12.9 [20]	13.6 [20]	12.1 [25]	13.9 [19]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	6.0 [6]	7.4 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1440 [16]	1400 [14]	1490 [18]	1570 [17]
Mean Asphalt Concrete Modulus (ksi), [CV]	443 [26]	440 [19]	478 [27]	502 [28]
Mean Base Modulus (ksi), [CV]	51.3 [18]	43.8 [19]	49.9 [14]	55.5 [24]
Subgrade Modulus (ksi), [CV]	15.0 [25]	16.6 [20]	16.2 [25]	17.6 [24]
August 11, 1999 [65, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1330 [11]	1330 [12]	1370 [12]	1410 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	522 [20]	518 [20]	534 [14]	556 [12]
Mean Base Modulus (ksi), [CV]	50.6 [20]	49.6 [16]	52.4 [17]	55.7 [17]
Subgrade Modulus (ksi), [CV]	14.6 [22]	14.9 [16]	15.3 [9.6]	15.1 [14]
May 11, 2000 [46, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [7]	5.9 [4]	7.9 [6]	9.7 [4]
Mean Pavement Stiffness (k/in.), [CV]	1410 [20]	1320 [20]	1430 [22]	1370 [21]
Mean Asphalt Concrete Modulus (ksi), [CV]	450 [27]	406 [24]	451 [28]	413 [25]
Mean Base Modulus (ksi), [CV]	33.4 [36]	28.1 [32]	33.5 [36]	36.2 [39]
Subgrade Modulus (ksi), [CV]	13.8 [15]	15.7 [17]	14.2 [14]	13.3 [29]
September 26, 2000 [43, 47]*				
Average Peak FWD Load (kips), [# tests]	9.3 [4]	No data	8.4 [3]	10.3 [4]
Mean Pavement Stiffness (k/in.), [CV]	1530 [8.5]		1580 [9.8]	1710 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	512 [25]		564 [17]	554 [26]
Mean Base Modulus (ksi), [CV]	47.9 [25]		45 [7.8]	57.2 [17]
Subgrade Modulus (ksi), [CV]	14.5 [5.1]		15.1 [13]	17.9 [17]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L2: Pavement Structural Condition – Deery 101, Shallow Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [58, 47]*				
Average Peak FWD Load (kips), [# tests]	9.2 [2]	No data	8.2 [1]	10.1 [2]
Mean Pavement Stiffness (k/in.), [CV]	1440 [6.3]		1540 [na]	1570 [1.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	576 [14]		619 [na]	607 [14]
Mean Base Modulus (ksi), [CV]	26.2 [36]		35.3 [na]	36.1 [15]
Subgrade Modulus (ksi), [CV]	14.0 [27]		14.6 [na]	14.4 [22]
October 2, 2001 [35, 52]*				
Average Peak FWD Load (kips), [# tests]	10.1 [5]	6.6 [1]	9.1 [2]	11.2 [5]
Mean Pavement Stiffness (k/in.), [CV]	1770 [13]	1340 [na]	1660 [23]	1860 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	690 [9.3]	592 [na]	685 [11]	735 [8.2]
Mean Base Modulus (ksi), [CV]	54.0 [38]	31.6 [na]	44.6 [49]	55.8 [44]
Subgrade Modulus (ksi), [CV]	17.1 [7.4]	13.9 [na]	18.6 [24]	19.1 [13]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.7 [2]	No data	7.8 [1]	9.8 [4]
Mean Pavement Stiffness (k/in.), [CV]	1540 [7.7]		1700 [na]	1730 [9.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	586 [19]		810 [na]	736 [20]
Mean Base Modulus (ksi), [CV]	38.6 [1.8]		34.2 [na]	35.7 [21]
Subgrade Modulus (ksi), [CV]	15.4 [9.7]		16.3 [na]	19.2 [21]
September 4, 2002 [63, 63]*				
Average Peak FWD Load (kips), [# tests]	9.2 [7]	No data	8.2 [7]	10.3 [7]
Mean Pavement Stiffness (k/in.), [CV]	1390 [10]		1420 [11]	1460 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	434 [12]		434 [11]	459 [9.6]
Mean Base Modulus (ksi), [CV]	63.9 [16]		66.3 [12]	67.9 [13]
Subgrade Modulus (ksi), [CV]	12.8 [17]		12.9 [14]	13.9 [21]
May 13, 2003 [51, 52]*				
Average Peak FWD Load (kips), [# tests]	9.1 [6]	No data	8.1 [6]	10.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1820 [12]		1770 [13]	1840 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	742 [26]		725 [24]	747 [31]
Mean Base Modulus (ksi), [CV]	47.8 [26]		44.6 [30]	52.2 [31]
Subgrade Modulus (ksi), [CV]	15.2 [13]		14.8 [17]	14.5 [14]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L3: Pavement Structural Condition – Deery 101 Square Reservoir and Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [60, 65]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	6.1 [6]	8.0 [6]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1340 [16]	1360 [15]	1400 [16]	1450 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	442 [14]	452 [15]	472 [15]	484 [17]
Mean Base Modulus (ksi), [CV]	42.1 [22]	38.2 [15]	42.1 [14]	48.4 [20]
Subgrade Modulus (ksi), [CV]	12.8 [28]	13.2 [18]	13.1 [15]	12.7 [16]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6.0]	6.0 [6.0]	7.4 [6.0]	10.1 [6.0]
Mean Pavement Stiffness (k/in.), [CV]	1470 [12]	1550 [16]	1520 [11]	1590 [9.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	426 [20]	498 [45]	447 [20]	452 [18]
Mean Base Modulus (ksi), [CV]	45.3 [25]	43.1 [35]	45.3 [24]	55.5 [30]
Subgrade Modulus (ksi), [CV]	11.8 [9.6]	12.5 [20]	12.1 [9.9]	12.3 [5.8]
August 11, 1999 [65, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	6.1 [5]	8.2 [5]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1420 [8.7]	1450 [8.9]	1470 [8.8]	1500 [8.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	597 [14]	605 [14]	610 [10]	647 [18]
Mean Base Modulus (ksi), [CV]	52.1 [23]	51.3 [25]	55.3 [24]	54.2 [20]
Subgrade Modulus (ksi), [CV]	14.1 [24]	14.1 [30]	13.9 [23]	15.6 [28]
May 11, 2000 [53, 47]*				
Average Peak FWD Load (kips), [# tests]	8.8 [2]	5.9 [4]	7.9 [5]	9.7 [2]
Mean Pavement Stiffness (k/in.), [CV]	1760 [27]	1750 [15]	1740 [15]	1710 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	529 [18]	606 [17]	660 [17]	638 [13]
Mean Base Modulus (ksi), [CV]	45.4 [20]	38.2 [18]	36.7 [38]	32.0 [4.0]
Subgrade Modulus (ksi), [CV]	8.0 [9.8]	11.6 [22]	12.2 [27]	14.8 [3.8]
September 26, 2000 [43, 47]*				
Average Peak FWD Load (kips), [# tests]	9.4 [1]	No data	8.4 [1]	10.3 [2]
Mean Pavement Stiffness (k/in.), [CV]	1760 [na]		1260 [na]	1580 [24]
Mean Asphalt Concrete Modulus (ksi), [CV]	721 [na]		636 [na]	741 [14]
Mean Base Modulus (ksi), [CV]	35.9 [na]		13.9 [na]	20.1 [44]
Subgrade Modulus (ksi), [CV]	18.1 [na]		13.9 [na]	18.0 [34]
Continued				

Continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L3: Pavement Structural Condition – Deery 101, Square Reservoir and Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [57, 46]*				
Average Peak FWD Load (kips), [# tests]	9.5 [5]	No data	8.2 [3]	No data
Mean Pavement Stiffness (k/in.), [CV]	1550 [4.7]		1510 [0.6]	
Mean Asphalt Concrete Modulus (ksi), [CV]	598 [16]		571 [15]	
Mean Base Modulus (ksi), [CV]	49.0 [20]		52.5 [0.7]	
Subgrade Modulus (ksi), [CV]	15.1 [23]		14.5 [11]	
October 2, 2001 [35, 52]*				
Average Peak FWD Load (kips), [# tests]	10.0 [3]	6.5 [1]	9.1 [3]	11.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1570 [14]	1300 [na]	1600 [14]	1730 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	733 [26]	542 [na]	689 [17]	739 [13]
Mean Base Modulus (ksi), [CV]	44.1 [56]	38.2 [na]	51.2 [17]	55.6 [32]
Subgrade Modulus (ksi), [CV]	16.4 [9.2]	18.9 [na]	16.4 [26]	15.7 [4.1]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.6 [2]	No data	7.7 [2]	9.6 [3]
Mean Pavement Stiffness (k/in.), [CV]	1540 [2.4]		1590 [2.1]	1470 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	760 [19]		799 [21]	760 [20]
Mean Base Modulus (ksi), [CV]	39.7 [59]		41.5 [71]	32.3 [82]
Subgrade Modulus (ksi), [CV]	17.5 [8.9]		16.7 [0.0]	16.1 [24]
September 4, 2002 [64, 62]*				
Average Peak FWD Load (kips), [# tests]	9.1 [6]	No data	8.2 [6]	10.3 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [14]		1480 [15]	1520 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	697 [38]		561 [22]	656 [40]
Mean Base Modulus (ksi), [CV]	51.3 [49]		68.8 [25]	59.2 [51]
Subgrade Modulus (ksi), [CV]	15.6 [37]		14.0 [36]	16.6 [42]
May 13, 2003 [57, 53]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	No data	8.2 [4]	10.3 [4]
Mean Pavement Stiffness (k/in.), [CV]	1770 [14]		1620 [9.1]	1670 [8.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	912 [14]		905 [13]	891 [18]
Mean Base Modulus (ksi), [CV]	35.7 [56]		35.7 [76]	40.9 [50]
Subgrade Modulus (ksi), [CV]	12.2 [12]		11.3 [13]	13.7 [47]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L4: Pavement Structural Condition – Deery 101, Square Reservoir and Recessed

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [60, 66]*				
Average Peak FWD Load (kips), [# tests]	8.7 [5]	6.1 [7]	8.0 [7]	9.7 [5]
Mean Pavement Stiffness (k/in.), [CV]	1180 [56]	1480 [45]	1540 [45]	1550 [54]
Mean Asphalt Concrete Modulus (ksi), [CV]	504 [23]	478 [28]	562 [38]	567 [22]
Mean Base Modulus (ksi), [CV]	49.4 [25]	63.9 [40]	53.1 [23]	72.3 [51]
Subgrade Modulus (ksi), [CV]	12.3 [24]	14.4 [50]	15.3 [30]	15.3 [17]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	6.0 [6.0]	7.4 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1580 [26]	1580 [25]	1620 [27]	1670 [27]
Mean Asphalt Concrete Modulus (ksi), [CV]	415 [28]	397 [17]	436 [29]	439 [31]
Mean Base Modulus (ksi), [CV]	63.5 [36]	67.7 [31]	61.7 [40]	71.4 [34]
Subgrade Modulus (ksi), [CV]	15.6 [44]	12.7 [31]	16.1 [47]	15.1 [50]
August 11, 1999 [66, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [7]	8.2 [7]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1510 [12]	1590 [16]	1630 [16]	1670 [17]
Mean Asphalt Concrete Modulus (ksi), [CV]	613 [20]	688 [32]	665 [18]	683 [21]
Mean Base Modulus (ksi), [CV]	60.1 [27]	51.9 [20]	59.2 [23]	60.7 [28]
Subgrade Modulus (ksi), [CV]	15.1 [17]	15.4 [10]	16.6 [26]	17.0 [18]
May 11, 2000 [52, 46]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.9 [8]	7.9 [6]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1800 [22]	1800 [20]	1780 [12]	1790 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	626 [18]	602 [13]	614 [11]	638 [14]
Mean Base Modulus (ksi), [CV]	40.1 [33]	39.9 [31]	42.9 [42]	41.4 [26]
Subgrade Modulus (ksi), [CV]	15.8 [15]	15.7 [22]	15.8 [28]	17.4 [22]
September 26, 2000 [44, 47]*				
Average Peak FWD Load (kips), [# tests]	9.3 [2]	6.2 [1]	8.4 [2]	10.3 [2]
Mean Pavement Stiffness (k/in.), [CV]	1660 [8.7]	1500 [na]	1680 [8.8]	1800 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	655 [31]	462 [na]	664 [29]	619 [13]
Mean Base Modulus (ksi), [CV]	64.7 [28]	74.0 [na]	62.5 [19]	68.5 [21]
Subgrade Modulus (ksi), [CV]	14.0 [13]	16.9 [na]	15.4 [22]	18.1 [5.5]
Continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L4: Pavement Structural Condition – Deery 101, Square Reservoir and Recessed (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [No data]*				
Average Peak FWD Load (kips), [# tests]	No data	No data	No data	No data
Mean Pavement Stiffness (k/in.), [CV]				
Mean Asphalt Concrete Modulus (ksi), [CV]				
Mean Base Modulus (ksi), [CV]				
Subgrade Modulus (ksi), [CV]				
October 2, 2001 [35, 52]*				
Average Peak FWD Load (kips), [# tests]	10.1 [1]	No data	No data	11.1 [2]
Mean Pavement Stiffness (k/in.), [CV]	1910 [na]			2090 [5.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	796 [na]			762 [14]
Mean Base Modulus (ksi), [CV]	38.1 [na]			90.8 [2.4]
Subgrade Modulus (ksi), [CV]	25.1 [na]			13.9 [5.6]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.7 [3]	No data	7.6 [1]	9.7 [3]
Mean Pavement Stiffness (k/in.), [CV]	1710 [7.1]		1520 [na]	1750 [8.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	751 [10]		730 [na]	756 [11]
Mean Base Modulus (ksi), [CV]	42.5 [33]		41.2 [na]	48.2 [31]
Subgrade Modulus (ksi), [CV]	17.9 [23]		16.4 [na]	17.8 [22]
September 4, 2002 [65, 61]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	No data	8.1 [6]	10.2 [6]
Mean Pavement Stiffness (k/in.), [CV]	1600 [17]		1620 [19]	1680 [19]
Mean Asphalt Concrete Modulus (ksi), [CV]	551 [24]		543 [19]	571 [22]
Mean Base Modulus (ksi), [CV]	69.9 [40]		73.0 [31]	75.0 [31]
Subgrade Modulus (ksi), [CV]	12.8 [27]		11.9 [25]	13.8 [29]
May 13, 2003 [53, 57]*				
Average Peak FWD Load (kips), [# tests]	8.8 [4]	No data	7.9 [3]	10.1 [3]
Mean Pavement Stiffness (k/in.), [CV]	1950 [11]		1840 [10]	1800 [2.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	923 [30]		833 [18]	800 [28]
Mean Base Modulus (ksi), [CV]	44.4 [96]		30.7 [76]	37.2 [120]
Subgrade Modulus (ksi), [CV]	13.6 [43]		14.2 [74]	14.4 [60]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L5: Pavement Structural Condition – Deery 101, Simple Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [60, 66]*				
Average Peak FWD Load (kips), [# tests]	8.7 [5]	6.0 [6]	7.9 [6]	9.6 [6]
Mean Pavement Stiffness (k/in.), [CV]	1080 [43]	1040 [51]	1080 [50]	1120 [50]
Mean Asphalt Concrete Modulus (ksi), [CV]	500 [17]	531 [13]	544 [12]	572 [13]
Mean Base Modulus (ksi), [CV]	41.1 [30]	34.6 [35]	43.5 [28]	45.6 [26]
Subgrade Modulus (ksi), [CV]	15.4 [14]	16.2 [17]	14.5 [16]	15.9 [8.5]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.2 [3]	5.9 [6]	7.3 [4]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1590 [26]	1620 [22]	1500 [28]	1620 [24]
Mean Asphalt Concrete Modulus (ksi), [CV]	384 [37]	427 [26]	367 [38]	386 [37]
Mean Base Modulus (ksi), [CV]	64.0 [15]	53.1 [30]	67.7 [16]	68.8 [16]
Subgrade Modulus (ksi), [CV]	11.5 [23]	12.4 [17]	9.4 [58]	11.1 [28]
August 11, 1999 [66, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1400 [6.5]	1400 [6.7]	1440 [6.6]	1520 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	799 [21]	747 [18]	811 [16]	901 [19]
Mean Base Modulus (ksi), [CV]	71.6 [31]	77.5 [31]	74.4 [21]	68.4 [32]
Subgrade Modulus (ksi), [CV]	13.7 [19]	13.8 [21]	14.7 [15]	15.3 [19]
May 11, 2000 [51, 46]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	5.9 [6]	7.9 [6]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	1580 [14]	1590 [12]	1530 [10]	1650 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	683 [18]	662 [13]	648 [18]	746 [7.8]
Mean Base Modulus (ksi), [CV]	35.7 [26]	42.7 [25]	38.3 [16]	40.1 [24]
Subgrade Modulus (ksi), [CV]	16.8 [10]	16.8 [15]	16.1 [16]	17.8 [8.8]
September 26, 2000 [45, 48]*				
Average Peak FWD Load (kips), [# tests]	9.2 [2]	6.2 [2]	8.3 [2]	10.2 [2]
Mean Pavement Stiffness (k/in.), [CV]	1370 [3.8]	1330 [5.4]	1390 [4.2]	1440 [3.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	518 [6.7]	493 [11]	548 [7.2]	575 [3.8]
Mean Base Modulus (ksi), [CV]	46.8 [21]	47.5 [8.6]	46.8 [13]	50.2 [12]
Subgrade Modulus (ksi), [CV]	17.1 [26]	14.9 [13]	16.3 [19]	16.7 [16]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L5: Pavement Structural Condition – Deery 101, Simple Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [50, 43]*				
Average Peak FWD Load (kips), [# tests]	9.1 [4]	6.1 [3]	8.2 [4]	10.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1160 [14]	1170 [16]	1180 [14]	1220 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	371 [29]	375 [35]	389 [29]	406 [29]
Mean Base Modulus (ksi), [CV]	34.2 [30]	33.0 [33]	32.0 [32]	33.0 [31]
Subgrade Modulus (ksi), [CV]	12.9 [34]	15.3 [9.6]	14.3 [12]	15.6 [11]
October 2, 2001 [35, 52]*				
Average Peak FWD Load (kips), [# tests]	10.0 [4]	6.6 [3]	9.0 [3]	11.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1570 [25]	1400 [24]	1450 [24]	1640 [24]
Mean Asphalt Concrete Modulus (ksi), [CV]	610 [45]	531 [59]	579 [58]	676 [44]
Mean Base Modulus (ksi), [CV]	65.3 [24]	64.0 [4.5]	60.2 [18]	60.5 [9.6]
Subgrade Modulus (ksi), [CV]	16.6 [14]	15.6 [10]	18.0 [18]	19.0 [5.9]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.6 [2]	No data	7.7 [2]	9.6 [3]
Mean Pavement Stiffness (k/in.), [CV]	1500 [7.1]		1520 [6.5]	1590 [5.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	671 [4.5]		755 [11]	791 [18]
Mean Base Modulus (ksi), [CV]	31.4 [38]		42.0 [10]	34.7 [19]
Subgrade Modulus (ksi), [CV]	19.2 [1.5]		18.4 [11]	19.4 [4.1]
September 4, 2002 [70, 69]*				
Average Peak FWD Load (kips), [# tests]	9.1 [7]	No data	8.0 [7]	10.2 [7]
Mean Pavement Stiffness (k/in.), [CV]	1420 [17]		1420 [16]	1450 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	694 [41]		676 [42]	761 [34]
Mean Base Modulus (ksi), [CV]	62.3 [29]		66.4 [27]	66.0 [18]
Subgrade Modulus (ksi), [CV]	17.7 [32]		17.1 [35]	18.2 [31]
May 13, 2003 [55, 53]*				
Average Peak FWD Load (kips), [# tests]	8.7 [3]	No data	8.0 [6]	10.2 [4]
Mean Pavement Stiffness (k/in.), [CV]	1320 [20]		1400 [19]	1500 [19]
Mean Asphalt Concrete Modulus (ksi), [CV]	387 [39]		526 [51]	684 [66]
Mean Base Modulus (ksi), [CV]	56.7 [32]		56.3 [17]	37.3 [55]
Subgrade Modulus (ksi), [CV]	17.6 [19]		11.3 [62]	13.1 [53]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L6: Pavement Structural Condition – Crafco 231, Shallow Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [58, 62]*				
Average Peak FWD Load (kips), [# tests]	8.6 [7]	6.0 [7]	7.9 [7]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1360 [8.3]	1340 [8.7]	1380 [8.1]	1420 [8.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	537 [12]	565 [11]	579 [9.2]	600 [10]
Mean Base Modulus (ksi), [CV]	62.3 [26]	47.4 [13]	55.4 [21]	57.8 [24]
Subgrade Modulus (ksi), [CV]	15.5 [42]	18.9 [16]	17.7 [7.1]	20.0 [23]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	5.9 [6]	7.4 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1460 [5.1]	1450 [5.3]	1480 [5.3]	1530 [5.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	660 [28]	673 [27]	680 [28]	720 [24]
Mean Base Modulus (ksi), [CV]	58.7 [22]	55.0 [21]	62.0 [20]	61.9 [16]
Subgrade Modulus (ksi), [CV]	17.6 [22]	17.3 [25]	16.3 [19]	18.6 [22]
August 11, 1999 [65, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6.0]	6.1 [6]	8.2 [6.0]	10.0 [6.0]
Mean Pavement Stiffness (k/in.), [CV]	1390 [4.7]	1370 [4.0]	1420 [4.3]	1460 [4.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	672 [20]	677 [20]	721 [21]	758 [16]
Mean Base Modulus (ksi), [CV]	89.7 [12]	83.9 [15]	85.8 [20]	90.3 [13]
Subgrade Modulus (ksi), [CV]	13.8 [19]	14.6 [20]	15.8 [17]	15.0 [18]
May 11, 2000 [49, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [8]	5.9 [8]	7.9 [8]	9.7 [7]
Mean Pavement Stiffness (k/in.), [CV]	1710 [15]	1700 [15]	1730 [15]	1800 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	732 [31]	733 [32]	773 [30]	794 [28]
Mean Base Modulus (ksi), [CV]	60.6 [35]	55.5 [41]	55.9 [33]	63.4 [31]
Subgrade Modulus (ksi), [CV]	18.4 [11]	19.4 [23]	19.4 [16]	20.4 [25]
September 26, 2000 [45, 48]*				
Average Peak FWD Load (kips), [# tests]	9.1 [6]	6.1 [6]	8.2 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1520 [20]	1490 [20]	1530 [19]	1600 [19]
Mean Asphalt Concrete Modulus (ksi), [CV]	570 [44]	564 [46]	588 [44]	612 [44]
Mean Base Modulus (ksi), [CV]	67.5 [11]	65.8 [12]	63.8 [13]	71.9 [12]
Subgrade Modulus (ksi), [CV]	20.0 [20]	17.8 [13]	21.2 [27]	21.0 [18]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L6: Pavement Structural Condition – Crafco 231, Shallow Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [50, 43]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.1 [7]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1450 [15]	1390 [11]	1480 [14]	1490 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	473 [34]	467 [39]	519 [34]	470 [28]
Mean Base Modulus (ksi), [CV]	55.3 [17]	48.8 [23]	54.5 [15]	54.8 [28]
Subgrade Modulus (ksi), [CV]	17.6 [10]	20.0 [17]	18.3 [13]	20.7 [8.1]
October 2, 2001 [34, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [7]	6.6 [6]	9.0 [7]	11.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1810 [8.7]	1750 [9.5]	1810 [8.9]	1840 [7.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	851 [23]	837 [25]	878 [24]	891 [23]
Mean Base Modulus (ksi), [CV]	79.5 [15]	64.6 [20]	75.2 [16]	73.1 [14]
Subgrade Modulus (ksi), [CV]	21.5 [16]	23.5 [20]	22.3 [16]	23.6 [19]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.4 [5]	5.7 [1]	7.5 [6]	9.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1570 [14]	1280 [na]	1560 [13]	1590 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	779 [34]	545 [na]	765 [32]	793 [36]
Mean Base Modulus (ksi), [CV]	46.5 [38]	40.3 [na]	47.8 [36]	46.6 [29]
Subgrade Modulus (ksi), [CV]	20.1 [18]	15.2 [na]	18.5 [26]	20.4 [28]
September 4, 2002 [71, 70]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	No data	8.1 [7]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1500 [5.4]		1540 [6.6]	1560 [6.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	633 [28]		698 [29]	681 [24]
Mean Base Modulus (ksi), [CV]	92.1 [12]		91.1 [11]	94.8 [16]
Subgrade Modulus (ksi), [CV]	18.5 [12]		17.8 [9.9]	20.7 [21]
May 13, 2003 [57, 73]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	No data	8.0 [5]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1820 [5.0]		1790 [4.5]	1890 [8.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	1220 [23]		1030 [12]	1320 [19]
Mean Base Modulus (ksi), [CV]	10.9 [18]		10.8 [17]	10.0 [0.5]
Subgrade Modulus (ksi), [CV]	6.8 [7.0]		6.7 [10]	7.0 [17]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L7: Pavement Structural Condition – Crafco 231, Square Reservoir and Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [58, 62]*				
Average Peak FWD Load (kips), [# tests]	8.6 [5]	6.0 [6]	7.9 [6]	9.6 [5]
Mean Pavement Stiffness (k/in.), [CV]	1380 [10]	1400 [11]	1450 [11]	1440 [9.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	564 [12]	560 [12]	551 [15]	610 [14]
Mean Base Modulus (ksi), [CV]	52.7 [33]	55.1 [42]	69.4 [36]	57.5 [23]
Subgrade Modulus (ksi), [CV]	20.2 [29]	18.6 [12]	16.1 [9.4]	18.9 [16]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.2 [6]	5.9 [6]	7.4 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [14]	1480 [15]	1510 [14]	1560 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	559 [20]	568 [20]	584 [20]	609 [18]
Mean Base Modulus (ksi), [CV]	78.6 [21]	71.7 [21]	77.0 [16]	82.1 [20]
Subgrade Modulus (ksi), [CV]	17.7 [11]	18.4 [10]	18.0 [15]	19.2 [11]
August 11, 1999 [65, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [16]	1480 [15]	1520 [15]	1550 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	846 [14]	811 [11]	877 [13]	927 [11]
Mean Base Modulus (ksi), [CV]	81.2 [20]	84.1 [26]	84.1 [19]	84.5 [22]
Subgrade Modulus (ksi), [CV]	16.3 [24]	15.5 [23]	15.5 [16]	16.7 [30]
May 11, 2000 [49, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [7]	5.9 [7]	7.9 [7]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	1600 [11]	1570 [12]	1630 [10]	1680 [9.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	554 [29]	546 [31]	622 [31]	580 [31]
Mean Base Modulus (ksi), [CV]	62.5 [21]	58.8 [25]	51.5 [31]	72.8 [27]
Subgrade Modulus (ksi), [CV]	17.8 [32]	17.2 [22]	19.5 [30]	16.8 [16]
September 26, 2000 [45, 47]*				
Average Peak FWD Load (kips), [# tests]	9.1 [3]	6.1 [3]	8.2 [5]	10.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1830 [8.1]	1520 [31]	1680 [22]	1720 [23]
Mean Asphalt Concrete Modulus (ksi), [CV]	685 [23]	652 [70]	656 [47]	672 [49]
Mean Base Modulus (ksi), [CV]	81.4 [1.9]	68.7 [15]	72.9 [11]	82.1 [11]
Subgrade Modulus (ksi), [CV]	18.7 [1.4]	19.6 [8.9]	19.7 [8.9]	18.3 [8.6]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L7: Pavement Structural Condition – Crafco 231, Square Reservoir and Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [50, 43]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [4]	8.1 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1470 [13]	1450 [12]	1520 [9.9]	1520 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	528 [25]	538 [14]	559 [14]	531 [23]
Mean Base Modulus (ksi), [CV]	51.8 [40]	61.0 [26]	56.2 [17]	53.5 [32]
Subgrade Modulus (ksi), [CV]	10.6 [36]	13.0 [42]	14.9 [29]	16.0 [35]
October 2, 2001 [34, 56]*				
Average Peak FWD Load (kips), [# tests]	10.0 [5]	6.6 [3]	9.0 [4]	11.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1730 [20]	1500 [9.5]	1610 [12]	1780 [23]
Mean Asphalt Concrete Modulus (ksi), [CV]	771 [19]	671 [8.0]	716 [12]	808 [19]
Mean Base Modulus (ksi), [CV]	71.3 [22]	61.2 [33]	73.3 [29]	72.3 [32]
Subgrade Modulus (ksi), [CV]	20.2 [18]	17.3 [9.7]	18.3 [9.3]	19.5 [15]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.4 [7]	No data	7.6 [7]	9.4 [7]
Mean Pavement Stiffness (k/in.), [CV]	1700 [8.5]		1710 [9.3]	1740 [8.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	780 [21]		808 [24]	805 [24]
Mean Base Modulus (ksi), [CV]	59.8 [25]		60.5 [19]	63.1 [21]
Subgrade Modulus (ksi), [CV]	20.0 [7.7]		19.3 [4.9]	20.4 [7.2]
September 4, 2002 [71, 70]*				
Average Peak FWD Load (kips), [# tests]	8.9 [6]	No data	7.9 [5]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [8.2]		1530 [7.2]	1550 [8.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	682 [30]		707 [13]	748 [24]
Mean Base Modulus (ksi), [CV]	88.1 [17]		93.1 [11]	87.0 [9.4]
Subgrade Modulus (ksi), [CV]	16.2 [16]		16.0 [20]	17.5 [18]
May 13, 2003 [57, 70]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.9 [5]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1780 [16]		1810 [17]	1830 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	1290 [30]		1200 [40]	1230 [29]
Mean Base Modulus (ksi), [CV]	18.7 [100]		17.6 [91]	15.8 [82]
Subgrade Modulus (ksi), [CV]	7.6 [32]		9.4 [27]	7.3 [22]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L8: Pavement Structural Condition – Crafco 231, Simple Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [59, 65]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	6.0 [7]	7.8 [7]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1360 [6.1]	1350 [5.7]	1400 [6.2]	1450 [6.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	546 [10]	564 [9.8]	567 [9.7]	582 [8.0]
Mean Base Modulus (ksi), [CV]	45.2 [15]	38.5 [20]	47.8 [18]	53.3 [19]
Subgrade Modulus (ksi), [CV]	17.4 [7.7]	18.5 [5.8]	17.5 [6.7]	18.5 [8.5]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.2 [5]	5.9 [5]	7.3 [5]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1350 [11]	1340 [10]	1370 [10]	1420 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	470 [36]	483 [38]	490 [38]	526 [38]
Mean Base Modulus (ksi), [CV]	60.1 [12]	52.5 [19]	57.1 [12]	61.5 [23]
Subgrade Modulus (ksi), [CV]	16.0 [8.0]	17.3 [14]	16.8 [18]	17.8 [17]
August 11, 1999 [64, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1440 [8.5]	1420 [9.4]	1480 [9.0]	1520 [8.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	747 [16]	689 [19]	744 [12]	819 [16]
Mean Base Modulus (ksi), [CV]	66.4 [25]	73.7 [20]	76.3 [29]	72.4 [33]
Subgrade Modulus (ksi), [CV]	17.2 [23]	14.5 [30]	15.0 [27]	16.4 [16]
May 11, 2000 [50, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [7]	5.9 [7]	7.9 [7]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	1820 [13]	1810 [13]	1840 [13]	1840 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	859 [15]	830 [16]	858 [12]	853 [13]
Mean Base Modulus (ksi), [CV]	61.4 [35]	55.0 [16]	61.5 [23]	64.8 [24]
Subgrade Modulus (ksi), [CV]	16.7 [21]	18.4 [24]	17.2 [17]	17.8 [20]
September 26, 2000 [49, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [4]	8.1 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1610 [8.7]	1590 [8.8]	1630 [8.3]	1680 [7.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	631 [17]	673 [14]	654 [16]	700 [16]
Mean Base Modulus (ksi), [CV]	61.2 [24]	60.2 [23]	57.1 [13]	62.6 [18]
Subgrade Modulus (ksi), [CV]	18.7 [16]	16.6 [13]	19.6 [28]	19.4 [21]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L8: Pavement Structural Condition – Crafco 231, Simple Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [55, 45]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [3]	8.0 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1380 [13]	1330 [1.6]	1450 [9.9]	1510 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	464 [31]	503 [13]	551 [19]	546 [39]
Mean Base Modulus (ksi), [CV]	50.7 [24]	43.6 [14]	48.8 [19]	54.8 [13]
Subgrade Modulus (ksi), [CV]	15.3 [17]	15.8 [4.2]	15.7 [11]	17.2 [13]
October 2, 2001 [32, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [6]	6.6 [4]	9.0 [6]	11.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1690 [6.2]	1630 [8.3]	1710 [6.0]	1780 [5.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	820 [31]	661 [21]	788 [30]	874 [30]
Mean Base Modulus (ksi), [CV]	56.2 [38]	69.8 [15]	63.7 [32]	59.8 [35]
Subgrade Modulus (ksi), [CV]	19.7 [18]	19.9 [8.7]	19.5 [13]	20.7 [18]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.3 [4]	No data	7.5 [5]	9.3 [5]
Mean Pavement Stiffness (k/in.), [CV]	1560 [13]		1670 [12]	1660 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	693 [31]		850 [29]	764 [31]
Mean Base Modulus (ksi), [CV]	46.2 [24]		39.4 [30]	48.1 [15]
Subgrade Modulus (ksi), [CV]	19.7 [27]		20.8 [24]	20.6 [24]
September 4, 2002 [71, 70]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	No data	8.0 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1500 [9.4]		1540 [11]	1560 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	821 [29]		797 [27]	853 [28]
Mean Base Modulus (ksi), [CV]	65.0 [54]		77.0 [43]	72.4 [55]
Subgrade Modulus (ksi), [CV]	15.6 [24]		16.1 [22]	15.7 [17]
May 13, 2003 [54, 66]*				
Average Peak FWD Load (kips), [# tests]	8.7 [4]	No data	8.1 [4]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	1740 [7.0]		1860 [12]	1910 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	960 [27]		931 [14]	1200 [22]
Mean Base Modulus (ksi), [CV]	10.0 [0]		12.3 [26]	10.2 [2.7]
Subgrade Modulus (ksi), [CV]	7.4 [22]		7.3 [8.6]	8.5 [23]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L9: Pavement Structural Condition – Crafco 231, Square Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [59, 65]*				
Average Peak FWD Load (kips), [# tests]	8.6 [5]	5.9 [6]	7.8 [6]	9.5 [6]
Mean Pavement Stiffness (k/in.), [CV]	1530 [5.2]	1530 [6.3]	1580 [5.3]	1630 [5.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	610 [20]	591 [14]	610 [14]	638 [20]
Mean Base Modulus (ksi), [CV]	57.3 [30]	56.8 [29]	66.0 [17]	66.6 [28]
Subgrade Modulus (ksi), [CV]	20.4 [34]	19.8 [14]	18.7 [22]	22.5 [28]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.2 [6]	5.9 [6]	7.3 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1500 [14]	1480 [13]	1520 [14]	1580 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	525 [31]	514 [27]	523 [28]	540 [29]
Mean Base Modulus (ksi), [CV]	63.8 [30]	60.6 [34]	66.1 [25]	74.7 [23]
Subgrade Modulus (ksi), [CV]	19.9 [25]	19.1 [22]	20.1 [28]	20.1 [11]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [6]	8.2 [7]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1610 [8.3]	1550 [8.8]	1640 [8.3]	1690 [8.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	888 [19]	843 [16]	904 [18]	910 [16]
Mean Base Modulus (ksi), [CV]	78.8 [31]	72.8 [35]	83.2 [32]	94.4 [25]
Subgrade Modulus (ksi), [CV]	17.7 [29]	16.0 [23]	16.7 [17]	15.2 [17]
May 11, 2000 [50, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.9 [6]	7.9 [3]	9.7 [4]
Mean Pavement Stiffness (k/in.), [CV]	1650 [16]	1620 [15]	1750 [19]	1720 [18]
Mean Asphalt Concrete Modulus (ksi), [CV]	562 [45]	606 [40]	698 [57]	676 [46]
Mean Base Modulus (ksi), [CV]	66.6 [33]	52.2 [41]	52.6 [26]	51.7 [50]
Subgrade Modulus (ksi), [CV]	16.9 [22]	18.7 [21]	18.9 [16]	19.4 [9.9]
September 26, 2000 [49, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.5 [4]	8.1 [5]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1710 [12]	1680 [15]	1690 [12]	1760 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	717 [24]	752 [28]	700 [25]	736 [25]
Mean Base Modulus (ksi), [CV]	67.8 [24]	64.3 [27]	67.4 [24]	68.4 [25]
Subgrade Modulus (ksi), [CV]	20.6 [14]	18.9 [15]	19.9 [14]	20.9 [6.1]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L9: Pavement Structural Condition – Crafco 231, Square Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [49, 43]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.1 [5]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1680 [3.3]		1700 [3.5]	1760 [2.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	468 [13]		479 [14]	512 [13]
Mean Base Modulus (ksi), [CV]	74.5 [17]		76.6 [18]	76.4 [20]
Subgrade Modulus (ksi), [CV]	18.8 [10]		17.7 [11]	19.7 [7.2]
October 2, 2001 [32, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [4]	6.6 [2]	9.0 [3]	11.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1900 [7.4]	1740 [4.7]	1860 [7.9]	1940 [7.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	841 [9.3]	880 [7.4]	872 [8.6]	911 [7.3]
Mean Base Modulus (ksi), [CV]	76.5 [15]	65.4 [3.2]	77.1 [15]	81.9 [18]
Subgrade Modulus (ksi), [CV]	23.1 [14]	19.6 [3.3]	20.8 [3.5]	21.5 [7.6]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.2 [5]	No data	7.4 [5]	9.2 [5]
Mean Pavement Stiffness (k/in.), [CV]	1580 [14]		1630 [17]	1610 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	768 [38]		772 [36]	795 [38]
Mean Base Modulus (ksi), [CV]	47.0 [37]		56.0 [52]	49.4 [38]
Subgrade Modulus (ksi), [CV]	17.9 [8.4]		17.8 [13]	18.4 [12]
September 4, 2002 [70, 71]*				
Average Peak FWD Load (kips), [# tests]	8.9 [7]	No data	8.0 [7]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1670 [7.5]		1710 [7.0]	1740 [7.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	803 [31]		740 [14]	932 [30]
Mean Base Modulus (ksi), [CV]	94.2 [17]		110 [17]	83.8 [43]
Subgrade Modulus (ksi), [CV]	18.1 [19]		16.9 [15]	22.6 [26]
May 13, 2003 [56, 64]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.7 [5]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1880 [16]		1780 [13]	1910 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	1020 [36]		995 [43]	1130 [37]
Mean Base Modulus (ksi), [CV]	25.6 [73]		22.0 [120]	22.0 [83]
Subgrade Modulus (ksi), [CV]	7.3 [18]		12.4 [77]	7.6 [21]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L10: Pavement Structural Condition – Crafco 231, Square Reservoir and Recess

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [59, 65]*				
Average Peak FWD Load (kips), [# tests]	8.5 [5]	5.9 [6]	7.7 [6]	9.5 [5]
Mean Pavement Stiffness (k/in.), [CV]	1510 [14]	1550 [14]	1600 [14]	1600 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	572 [22]	608 [20]	637 [20]	616 [20]
Mean Base Modulus (ksi), [CV]	57.3 [37]	50.5 [31]	54.1 [27]	60.2 [33]
Subgrade Modulus (ksi), [CV]	18.6 [12]	19.6 [17]	20.4 [17]	20.7 [13]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [2]	5.8 [2]	7.3 [2]	9.9 [2]
Mean Pavement Stiffness (k/in.), [CV]	1720 [0.7]	1700 [0.8]	1730 [0.9]	1810 [0.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	676 [19]	687 [12]	672 [16]	751 [16]
Mean Base Modulus (ksi), [CV]	79.1 [31]	69.6 [8.5]	80.6 [22]	78.9 [23]
Subgrade Modulus (ksi), [CV]	17.1 [21]	17.4 [6.1]	17.2 [8.2]	20.1 [5.6]
August 11, 1999 [66, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1660 [9.2]	1640 [8.8]	1690 [9.2]	1740 [9.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	910 [5.8]	906 [4.4]	944 [10]	1016 [6.7]
Mean Base Modulus (ksi), [CV]	87.6 [23]	79.1 [26]	89.9 [29]	86.1 [27]
Subgrade Modulus (ksi), [CV]	16.8 [22]	18.0 [16]	16.2 [10]	18.2 [11]
May 11, 2000 [**No data**]*				
Average Peak FWD Load (kips), [# tests]	No data	No data	No data	No data
Mean Pavement Stiffness (k/in.), [CV]				
Mean Asphalt Concrete Modulus (ksi), [CV]				
Mean Base Modulus (ksi), [CV]				
Subgrade Modulus (ksi), [CV]				
September 26, 2000 [51, 50]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	No data	8.1 [7]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1820 [9.6]		1860 [9.3]	1920 [9.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	676 [32]		721 [28]	777 [29]
Mean Base Modulus (ksi), [CV]	79.9 [13]		80.9 [15]	83.8 [11]
Subgrade Modulus (ksi), [CV]	19.7 [10]		19.9 [12]	20.3 [12]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L10: Pavement Structural Condition – Crafco 231, Square Reservoir and Recess (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [45, 41]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	No data	8.1 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1530 [20]		1550 [20]	1600 [20]
Mean Asphalt Concrete Modulus (ksi), [CV]	460 [36]		466 [35]	495 [34]
Mean Base Modulus (ksi), [CV]	56.0 [29]		57.3 [31]	59.4 [31]
Subgrade Modulus (ksi), [CV]	18.9 [9.2]		18.9 [6.0]	18.9 [11]
October 2, 2001 [34, 55]*				
Average Peak FWD Load (kips), [# tests]	10.0 [5]	6.6 [2]	9.0 [5]	11.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1890 [11]	1670 [14]	1900 [11]	1990 [9.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	935 [14]	796 [23]	936 [15]	989 [11]
Mean Base Modulus (ksi), [CV]	72.9 [20]	66.5 [29]	76.9 [19]	79.3 [18]
Subgrade Modulus (ksi), [CV]	19.9 [12]	17.8 [15]	19.2 [11]	21.0 [15]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.3 [5]	No data	7.5 [6]	9.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1750 [13]		1760 [12]	1810 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	711 [38]		707 [38]	711 [32]
Mean Base Modulus (ksi), [CV]	70.6 [14]		70.1 [11]	72.6 [14]
Subgrade Modulus (ksi), [CV]	19.3 [4.4]		19.3 [8.0]	21.4 [5.0]
September 4, 2002 [71, 70]*				
Average Peak FWD Load (kips), [# tests]	8.9 [6]	No data	8.0 [4]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1630 [9.3]		1590 [12]	1700 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	948 [25]		832 [16]	986 [21]
Mean Base Modulus (ksi), [CV]	63.6 [30]		81.6 [10]	69.5 [34]
Subgrade Modulus (ksi), [CV]	19.8 [54]		15.6 [38]	20.7 [46]
May 13, 2003 [56, 61]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.8 [6]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1950 [6.4]		1910 [6.9]	1970 [5.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	1210 [27]		1040 [19]	1170 [24]
Mean Base Modulus (ksi), [CV]	46.4 [82]		49.7 [64]	51.3 [76]
Subgrade Modulus (ksi), [CV]	12.1 [42]		15.0 [64]	13.0 [42]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L11: Pavement Structural Condition – Maxwell 72, Square Reservoir and Band-Aid

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [63, 73]*				
Average Peak FWD Load (kips), [# tests]	8.4 [7]	5.8 [7]	7.6 [7]	9.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1380 [12]	1350 [12]	1410 [13]	1460 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	480 [20]	482 [20]	519 [19]	531 [21]
Mean Base Modulus (ksi), [CV]	55.4 [18]	48.4 [21]	51.6 [19]	55.4 [18]
Subgrade Modulus (ksi), [CV]	13.9 [17]	14.7 [20]	15.2 [15]	15.5 [16]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [11]	5.8 [11]	7.3 [11]	9.9 [11]
Mean Pavement Stiffness (k/in.), [CV]	1520 [16]	1500 [17]	1540 [17]	1590 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	500 [31]	493 [29]	511 [30]	525 [30]
Mean Base Modulus (ksi), [CV]	68.7 [30]	64.4 [29]	67.8 [24]	75.6 [24]
Subgrade Modulus (ksi), [CV]	16.5 [27]	16.6 [21]	17.1 [22]	17.1 [20]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	6.1 [6]	8.2 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1680 [12]	1630 [11]	1710 [12]	1750 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	885 [11]	847 [17]	953 [13]	913 [8.5]
Mean Base Modulus (ksi), [CV]	78.4 [15]	65.7 [27]	73.2 [26]	77.5 [30]
Subgrade Modulus (ksi), [CV]	13.8 [12]	16.6 [27]	16.0 [23]	14.9 [13]
May 11, 2000 [49, 45]*				
Average Peak FWD Load (kips), [# tests]	8.7 [3]	5.9 [3]	7.9 [5]	9.7 [4]
Mean Pavement Stiffness (k/in.), [CV]	1260 [13]	1250 [14]	1490 [28]	1350 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	376 [39]	364 [32]	544 [44]	503 [38]
Mean Base Modulus (ksi), [CV]	33.7 [26]	34.2 [16]	41.4 [44]	31.8 [20]
Subgrade Modulus (ksi), [CV]	16.6 [25]	15.8 [16]	15.9 [17]	17.6 [9.0]
September 26, 2000 [53, 51]*				
Average Peak FWD Load (kips), [# tests]	8.9 [4]	6.0 [2]	8.0 [3]	9.9 [4]
Mean Pavement Stiffness (k/in.), [CV]	1530 [30]	1230 [26]	1340 [19]	1610 [29]
Mean Asphalt Concrete Modulus (ksi), [CV]	619 [52]	529 [68]	496 [53]	624 [48]
Mean Base Modulus (ksi), [CV]	57.8 [41]	35.0 [9.1]	59.2 [20]	68.0 [39]
Subgrade Modulus (ksi), [CV]	18.0 [31]	19.9 [26]	15.5 [27]	18.1 [33]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L11: Pavement Structural Condition – Maxwell 72, Square Reservoir and Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [45. 41]*				
Average Peak FWD Load (kips), [# tests]	9.1 [3]	6.1 [1]	8.2 [3]	10.1 [3]
Mean Pavement Stiffness (k/in.), [CV]	1300 [18]	1480 [na]	1320 [19]	1360 [17]
Mean Asphalt Concrete Modulus (ksi), [CV]	361 [51]	596 [na]	353 [51]	401 [54]
Mean Base Modulus (ksi), [CV]	49.7 [28]	51.7 [na]	53.8 [31]	50.3 [28]
Subgrade Modulus (ksi), [CV]	18.1 [22]	22.0 [na]	17.9 [24]	18.7 [20]
October 2, 2001 [35, 55]*				
Average Peak FWD Load (kips), [# tests]	9.9 [4]	6.5 [1]	8.9 [4]	11.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1620 [19]	1560 [na]	1640 [18]	1580 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	618 [43]	686 [na]	630 [41]	557 [33]
Mean Base Modulus (ksi), [CV]	72.0 [17]	79.6 [na]	71.4 [32]	71.1 [23]
Subgrade Modulus (ksi), [CV]	17.2 [10]	17.0 [na]	18.4 [34]	19.9 [21]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	5.6 [2]	7.9 [4]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1390 [14]	1400 [2.1]	1390 [18]	1440 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	665 [43]	687 [7.5]	613 [37]	728 [40]
Mean Base Modulus (ksi), [CV]	39.6 [62]	40.7 [23]	41.7 [26]	35.1 [45]
Subgrade Modulus (ksi), [CV]	15.0 [21]	16.3 [6.5]	15.3 [11]	16.2 [14]
September 4, 2002 [75, 77]*				
Average Peak FWD Load (kips), [# tests]	9.2 [5]	5.5 [1]	8.3 [4]	10.3 [6]
Mean Pavement Stiffness (k/in.), [CV]	1390 [20]	1360 [na]	1390 [23]	1420 [18]
Mean Asphalt Concrete Modulus (ksi), [CV]	534 [34]	587 [na]	493 [31]	543 [27]
Mean Base Modulus (ksi), [CV]	96.2 [32]	85.5 [na]	104 [34]	97.7 [33]
Subgrade Modulus (ksi), [CV]	15.9 [18]	19.3 [na]	16.8 [19]	16.0 [22]
May 13, 2003 [61, 57]*				
Average Peak FWD Load (kips), [# tests]	8.7 [5]	No data	7.8 [5]	9.7 [5]
Mean Pavement Stiffness (k/in.), [CV]	1570 [11]		1530 [11]	1630 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	627 [22]		669 [35]	639 [27]
Mean Base Modulus (ksi), [CV]	67.4 [41]		57.0 [39]	71.8 [53]
Subgrade Modulus (ksi), [CV]	21.4 [30]		17.8 [46]	15.7 [41]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L12: Pavement Structural Condition – Maxwell 72, Shallow Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [64, 76]*				
Average Peak FWD Load (kips), [# tests]	8.4 [5]	5.9 [6]	7.6 [5]	9.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1570 [4.1]	1570 [5.4]	1620 [6.3]	1680 [6.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	520 [15]	565 [15]	572 [19]	630 [21]
Mean Base Modulus (ksi), [CV]	84.7 [19]	73.1 [21]	86.9 [21]	77.8 [39]
Subgrade Modulus (ksi), [CV]	18.5 [12]	20.0 [18]	18.2 [16]	26.9 [53]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.9 [6]	7.3 [6]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1630 [12]	1620 [12]	1660 [12]	1670 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	573 [18]	560 [13]	544 [13]	602 [6.7]
Mean Base Modulus (ksi), [CV]	68.7 [32]	69.7 [32]	80.6 [29]	72.1 [31]
Subgrade Modulus (ksi), [CV]	18.5 [24]	17.1 [16]	16.7 [19]	20.1 [15]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1760 [4.6]	1730 [4.3]	1790 [4.6]	1840 [4.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	1000 [26]	974 [25]	1028 [30]	1081 [34]
Mean Base Modulus (ksi), [CV]	86.4 [24]	86.4 [19]	92.6 [30]	96.5 [24]
Subgrade Modulus (ksi), [CV]	17.5 [20]	16.2 [30]	16.9 [20]	16.1 [26]
May 11, 2000 [500, 45]*				
Average Peak FWD Load (kips), [# tests]	8.8 [8]	6.0 [8]	8.0 [7]	9.7 [8]
Mean Pavement Stiffness (k/in.), [CV]	1910 [5.2]	1900 [5.8]	1950 [5.8]	1980 [5.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	656 [26]	647 [20]	730 [22]	685 [24]
Mean Base Modulus (ksi), [CV]	81.4 [18]	77.8 [17]	73.9 [16]	83.4 [26]
Subgrade Modulus (ksi), [CV]	18.5 [28]	18.3 [15]	18.6 [15]	21.5 [41]
September 26, 2000 [55, 52]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.1 [4]	10.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1980 [5.2]		1970 [6.5]	2070 [5.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	811 [23]		794 [27]	878 [15]
Mean Base Modulus (ksi), [CV]	79.1 [12]		79.9 [22]	87.9 [5.7]
Subgrade Modulus (ksi), [CV]	23.0 [16]		23.9 [17]	21.9 [14]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L12: Pavement Structural Condition – Maxwell 72, Shallow Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [54, 45]*				
Average Peak FWD Load (kips), [# tests]	9.0 [4]	No data	8.1 [4]	10.1 [3]
Mean Pavement Stiffness (k/in.), [CV]	1770 [9.9]		1790 [9.2]	1790 [8.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	556 [29]		546 [25]	563 [34]
Mean Base Modulus (ksi), [CV]	82.3 [14]		81.7 [12]	78.2 [10]
Subgrade Modulus (ksi), [CV]	15.5 [26]		18.9 [27]	17.9 [22]
October 2, 2001 [35, 55]*				
Average Peak FWD Load (kips), [# tests]	9.9 [1]	6.5 [1]	No data	No data
Mean Pavement Stiffness (k/in.), [CV]	1470 [na]	1430 [na]		
Mean Asphalt Concrete Modulus (ksi), [CV]	321 [na]	315 [na]		
Mean Base Modulus (ksi), [CV]	96.7 [na]	87.1 [na]		
Subgrade Modulus (ksi), [CV]	23.0 [na]	24.5 [na]		
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.2 [4]	10.2 [6]
Mean Pavement Stiffness (k/in.), [CV]	1750 [11]		1820 [11]	1850 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	595 [50]		660 [48]	646 [45]
Mean Base Modulus (ksi), [CV]	83.0 [22]		82.0 [20]	86.2 [22]
Subgrade Modulus (ksi), [CV]	19.3 [14]		18.2 [12]	19.6 [16]
September 4, 2002 [74, 79]*				
Average Peak FWD Load (kips), [# tests]	9.3 [6]	No data	8.3 [5]	10.4 [6]
Mean Pavement Stiffness (k/in.), [CV]	1680 [10]		1630 [5.9]	1690 [6.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	701 [50]		592 [24]	599 [23]
Mean Base Modulus (ksi), [CV]	114 [27]		120 [16]	131 [16]
Subgrade Modulus (ksi), [CV]	17.4 [12]		17.6 [11]	18.1 [10]
May 13, 2003 [55, 60]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	No data	8.0 [5]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	2170 [8.6]		2150 [8.0]	2170 [8.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	1650 [16]		1540 [17]	1380 [31]
Mean Base Modulus (ksi), [CV]	22.7 [44]		31.4 [86]	50.5 [63]
Subgrade Modulus (ksi), [CV]	13.6 [62]		12.4 [28]	21.2 [50]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L13: Pavement Structural Condition – Maxwell 72, Simple Band-Aid

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [64, 76]*				
Average Peak FWD Load (kips), [# tests]	7.8 [26]	5.8 [6]	7.6 [6]	9.3 [6]
Mean Pavement Stiffness (k/in.), [CV]	1340 [48]	1630 [6.9]	1700 [7.0]	1770 [7.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	496 [48]	608 [19]	648 [18]	648 [17]
Mean Base Modulus (ksi), [CV]	65.6 [50]	66.7 [23]	71.2 [22]	86.3 [22]
Subgrade Modulus (ksi), [CV]	17.8 [57]	19.0 [11]	20.3 [13]	19.0 [11]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.3 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1630 [12]	1630 [13]	1660 [12]	1730 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	425 [26]	479 [31]	452 [27]	457 [28]
Mean Base Modulus (ksi), [CV]	94.7 [21]	78.6 [27]	90.4 [22]	101.2 [20]
Subgrade Modulus (ksi), [CV]	14.9 [20]	16.5 [23]	16.3 [13]	17.7 [17]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1760 [12]	1740 [11]	1800 [12]	1840 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	667 [30]	615 [25]	678 [24]	707 [31]
Mean Base Modulus (ksi), [CV]	98.9 [13]	112.3 [17]	108.3 [11]	101.8 [18]
Subgrade Modulus (ksi), [CV]	19.7 [20]	15.1 [8.1]	16.5 [15]	22.5 [19]
May 11, 2000 [54, 47]*				
Average Peak FWD Load (kips), [# tests]	8.8 [7]	5.9 [8]	7.9 [8]	9.7 [8]
Mean Pavement Stiffness (k/in.), [CV]	1880 [9.1]	1850 [8.5]	1900 [8.6]	1950 [8.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	704 [11]	721 [15]	775 [18]	775 [20]
Mean Base Modulus (ksi), [CV]	70.2 [18]	62.9 [26]	64.6 [32]	71.8 [29]
Subgrade Modulus (ksi), [CV]	16.0 [22]	16.4 [19]	16.4 [16]	17.8 [24]
September 26, 2000 [55, 52]*				
Average Peak FWD Load (kips), [# tests]	8.9 [3]	No data	No data	9.9 [2]
Mean Pavement Stiffness (k/in.), [CV]	2010 [9.7]			1990 [1.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	823 [12]			870 [15]
Mean Base Modulus (ksi), [CV]	86.7 [19]			65.6 [25]
Subgrade Modulus (ksi), [CV]	20.8 [9.4]			17.5 [21]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L13: Pavement Structural Condition – Maxwell 72, Simple Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [57, 46]*				
Average Peak FWD Load (kips), [# tests]	9.0 [3]	No data	8.0 [1]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1730 [15]		1670 [na]	1760 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	563 [36]		625 [na]	587 [32]
Mean Base Modulus (ksi), [CV]	77.9 [19]		57.2 [na]	64.4 [43]
Subgrade Modulus (ksi), [CV]	14.4 [28]		16.2 [na]	16.4 [31]
October 2, 2001 [34, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [2]	No data	9.0 [2]	11.0 [2]
Mean Pavement Stiffness (k/in.), [CV]	2120 [0.3]		2170 [0.5]	2230 [0.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	869 [6.8]		975 [1.5]	962 [9.6]
Mean Base Modulus (ksi), [CV]	83.7 [12]		89.7 [0.3]	76.5 [15]
Subgrade Modulus (ksi), [CV]	21.0 [9.6]		20.7 [26]	24.4 [21]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.1 [5]	No data	8.2 [3]	10.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1910 [5.7]		1990 [6.5]	1870 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	834 [20]		814 [27]	760 [34]
Mean Base Modulus (ksi), [CV]	61.8 [36]		83.2 [18]	62.0 [21]
Subgrade Modulus (ksi), [CV]	21.6 [20]		21.8 [5.4]	20.7 [11]
September 4, 2002 [73, 80]*				
Average Peak FWD Load (kips), [# tests]	No data	No data	9.2 [5]	10.3 [6]
Mean Pavement Stiffness (k/in.), [CV]			1700 [10]	1760 [9.1]
Mean Asphalt Concrete Modulus (ksi), [CV]			576 [17]	592 [18]
Mean Base Modulus (ksi), [CV]			130 [14]	135 [12]
Subgrade Modulus (ksi), [CV]			15.3 [11]	18.6 [16]
May 13, 2003 [56, 60]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	No data	7.9 [6]	9.9 [4]
Mean Pavement Stiffness (k/in.), [CV]	2120 [12]		2040 [12]	2120 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	1140 [36]		1220 [30]	1050 [28]
Mean Base Modulus (ksi), [CV]	53.1 [37]		42.6 [77]	69.5 [40]
Subgrade Modulus (ksi), [CV]	27.0 [57]		18.5 [55]	27.6 [26]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L14: Pavement Structural Condition – Maxwell 72, Square Reservoir and Recess

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [65, 78]*				
Average Peak FWD Load (kips), [# tests]	8.4 [6]	5.8 [7]	7.6 [7]	9.3 [6]
Mean Pavement Stiffness (k/in.), [CV]	1730 [3.3]	1650 [6.9]	1720 [6.6]	1790 [6.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	617 [6.5]	598 [13]	643 [16]	717 [32]
Mean Base Modulus (ksi), [CV]	86.4 [23]	68.8 [15]	74.7 [14]	76.9 [35]
Subgrade Modulus (ksi), [CV]	18.3 [20]	20.0 [13]	20.5 [29]	22.8 [49]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.3 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1670 [12]	1660 [12]	1690 [12]	1790 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	571 [33]	577 [28]	551 [30]	603 [34]
Mean Base Modulus (ksi), [CV]	79.7 [28]	74.0 [27]	84.0 [24]	91.0 [26]
Subgrade Modulus (ksi), [CV]	17.4 [26]	16.9 [13]	18.4 [18]	19.7 [21]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.2 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1870 [6.6]	1840 [7.1]	1910 [6.4]	1970 [6.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	862 [19]	835 [19]	899 [19]	922 [18]
Mean Base Modulus (ksi), [CV]	104.7 [24]	104.7 [25]	108.1 [22]	115.4 [19]
Subgrade Modulus (ksi), [CV]	19.4 [12]	16.4 [20]	18.0 [19]	18.2 [9.7]
May 11, 2000 [59, 49]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.9 [6]	7.9 [5]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	1920 [9.3]	1850 [10]	1940 [11]	1980 [9.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	742 [20]	732 [15]	785 [17]	836 [12]
Mean Base Modulus (ksi), [CV]	75.4 [9.9]	61.9 [35]	65.6 [12]	66.8 [26]
Subgrade Modulus (ksi), [CV]	15.4 [29]	15.9 [21]	20.4 [39]	18.5 [17]
September 26, 2000 [56, 52]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	8.1 [1]	9.9 [3]
Mean Pavement Stiffness (k/in.), [CV]	1920 [5.6]		1900 [na]	1990 [6.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	791 [23]		1002 [na]	835 [28]
Mean Base Modulus (ksi), [CV]	82.9 [16]		63.6 [na]	80.9 [15]
Subgrade Modulus (ksi), [CV]	18.0 [19]		14.6 [na]	20.1 [13]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L14: Pavement Structural Condition – Maxwell 72, Square Reservoir and Recess (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [55, 45]*				
Average Peak FWD Load (kips), [# tests]	9.1 [5]	No data	8.1 [3]	10.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1690 [13]		1660 [13]	1770 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	475 [43]		499 [47]	510 [40]
Mean Base Modulus (ksi), [CV]	77.3 [16]		76.3 [15]	83.2 [9.3]
Subgrade Modulus (ksi), [CV]	19.6 [15]		17.5 [16]	20.1 [7.4]
October 2, 2001 [34, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [1]	No data	9.0 [1]	11.1 [2]
Mean Pavement Stiffness (k/in.), [CV]	2010 [na]		2020 [na]	2110 [0.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	984 [na]		961 [na]	857 [26]
Mean Base Modulus (ksi), [CV]	80.0 [na]		68.6 [na]	91.4 [5.9]
Subgrade Modulus (ksi), [CV]	19.3 [na]		26.3 [na]	24.2 [16]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.1 [4]	No data	8.1 [4]	10.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1990 [6.5]		1890 [9.2]	1920 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	793 [13]		723 [19]	71.8 [28]
Mean Base Modulus (ksi), [CV]	73.6 [9.6]		74.2 [6.8]	81.1 [9.4]
Subgrade Modulus (ksi), [CV]	22.7 [6.8]		22.1 [13]	22.8 [11]
September 4, 2002 [73, 80]*				
Average Peak FWD Load (kips), [# tests]	9.2 [6]	No data	8.2 [5]	10.3 [7]
Mean Pavement Stiffness (k/in.), [CV]	1760 [7.2]		1750 [7.9]	1820 [6.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	757 [40]		640 [3.8]	699 [11]
Mean Base Modulus (ksi), [CV]	112 [37]		130 [17]	125 [29]
Subgrade Modulus (ksi), [CV]	22.3 [21]		19.6 [9.7]	26.1 [38]
May 13, 2003 [60, 59]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	No data	8.0 [6]	10.3 [5]
Mean Pavement Stiffness (k/in.), [CV]	1830 [14]		1810 [14]	1840 [15]
Mean Asphalt Concrete Modulus (ksi), [CV]	850 [42]		983 [43]	854 [44]
Mean Base Modulus (ksi), [CV]	79.0 [41]		58.0 [54]	72.1 [20]
Subgrade Modulus (ksi), [CV]	17.9 [54]		13.9 [63]	17.9 [64]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L15: Pavement Structural Condition – Maxwell 72, Square Reservoir and Flush

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [65, 78]*				
Average Peak FWD Load (kips), [# tests]	8.4 [7]	5.8 [7]	7.5 [7]	9.3 [7]
Mean Pavement Stiffness (k/in.), [CV]	1450 [6.8]	1410 [7.3]	1480 [6.8]	1560 [7.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	485 [13]	495 [13]	503 [13]	529 [13]
Mean Base Modulus (ksi), [CV]	65.7 [25]	55.0 [31]	64.2 [26]	73.5 [24]
Subgrade Modulus (ksi), [CV]	14.9 [14]	15.6 [8.3]	15.4 [9.4]	15.1 [15]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.3 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1720 [14]	1700 [14]	1740 [14]	1820 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	508 [26]	533 [28]	526 [26]	536 [24]
Mean Base Modulus (ksi), [CV]	85.7 [21]	77.4 [24]	82.3 [23]	93.5 [18]
Subgrade Modulus (ksi), [CV]	16.5 [15]	15.3 [13]	17.9 [17]	18.7 [9.5]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	8.9 [7]	6.0 [7]	8.1 [7]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1680 [8.2]	1650 [8.9]	1720 [8.3]	1780 [7.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	802 [14]	737 [13]	840 [14]	857 [20]
Mean Base Modulus (ksi), [CV]	76.1 [21]	83.3 [26]	78.0 [27]	82.3 [22]
Subgrade Modulus (ksi), [CV]	16.5 [30]	14.7 [17]	15.7 [9.4]	17.5 [27]
May 11, 2000 [61, 50]*				
Average Peak FWD Load (kips), [# tests]	8.8 [1]	5.9 [1]	7.9 [1]	9.8 [1]
Mean Pavement Stiffness (k/in.), [CV]	1660 [na]	1610 [na]	1690 [na]	1770 [na]
Mean Asphalt Concrete Modulus (ksi), [CV]	766 [na]	754 [na]	822 [na]	761 [na]
Mean Base Modulus (ksi), [CV]	30.1 [na]	23.1 [na]	27.1 [na]	54.6 [na]
Subgrade Modulus (ksi), [CV]	17.8 [na]	20.4 [na]	18.3 [na]	14.8 [na]
September 26, 2000 [57, 53]*				
Average Peak FWD Load (kips), [# tests]	9.0 [3]	No data	8.1 [2]	9.9 [3]
Mean Pavement Stiffness (k/in.), [CV]	1760 [16]		1850 [20]	1830 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	718 [30]		809 [50]	693 [21]
Mean Base Modulus (ksi), [CV]	57.2 [52]		67.7 [23]	56.9 [59]
Subgrade Modulus (ksi), [CV]	22.3 [16]		19.9 [11]	22.6 [8.7]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L15: Pavement Structural Condition – Maxwell 72, Square Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [51, 44]*				
Average Peak FWD Load (kips), [# tests]	9.0 [3]		8.2 [2]	10.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1650 [8.2]	No data	1590 [2.2]	1720 [8.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	530 [4.4]		542 [2.2]	531 [3.1]
Mean Base Modulus (ksi), [CV]	44.0 [38]		38.9 [24]	57.3 [36]
Subgrade Modulus (ksi), [CV]	21.7 [20]		17.8 [6.8]	19.2 [13]
October 2, 2001 [34, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [4]	No data	9.0 [1]	11.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1800 [5.3]		1880 [na]	1900 [4.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	640 [18]		776 [na]	698 [16]
Mean Base Modulus (ksi), [CV]	71.8 [24]		87.3 [na]	72.5 [19]
Subgrade Modulus (ksi), [CV]	17.3 [16]		16.0 [na]	19.4 [13]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.1 [4]	10.2 [5]
Mean Pavement Stiffness (k/in.), [CV]	1750 [12]		1750 [13]	1820 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	629 [25]		658 [33]	633 [26]
Mean Base Modulus (ksi), [CV]	65.7 [20]		61.9 [23]	76.5 [12]
Subgrade Modulus (ksi), [CV]	18.5 [6.7]		18.9 [17]	18.9 [21]
September 4, 2002 [73, 80]*				
Average Peak FWD Load (kips), [# tests]	9.2 [3]	No data	No data	10.3 [4]
Mean Pavement Stiffness (k/in.), [CV]	1450 [7.6]			1570 [6.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	534 [7.2]			582 [21]
Mean Base Modulus (ksi), [CV]	88.1 [21]			102 [34]
Subgrade Modulus (ksi), [CV]	13.6 [9.0]			15.4 [13]
May 13, 2003 [58, 62]*				
Average Peak FWD Load (kips), [# tests]	8.7 [3]	No data	7.9 [3]	9.8 [3]
Mean Pavement Stiffness (k/in.), [CV]	1990 [19]		1970 [19]	1940 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	910 [55]		1170 [43]	992 [55]
Mean Base Modulus (ksi), [CV]	74.3 [34]		37.5 [62]	57.1 [87]
Subgrade Modulus (ksi), [CV]	18.2 [27]		11.4 [15]	17.5 [24]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L16: Pavement Structural Condition – Crafco 522, Square Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [65, 78]*				
Average Peak FWD Load (kips), [# tests]	8.3 [7]	5.7 [7]	7.5 [7]	9.2 [5]
Mean Pavement Stiffness (k/in.), [CV]	1350 [9.3]	1310 [10]	1370 [9.2]	1400 [8.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	539 [21]	551 [23]	555 [23]	525 [17]
Mean Base Modulus (ksi), [CV]	53.4 [22]	42.5 [24]	53.7 [19]	62.0 [19]
Subgrade Modulus (ksi), [CV]	15.5 [10]	16.4 [10]	15.1 [12]	16.4 [11]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.2 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1480 [12]	1470 [12]	1500 [12]	1570 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	573 [33]	605 [36]	597 [36]	602 [27]
Mean Base Modulus (ksi), [CV]	54.9 [15]	46.9 [15]	53.4 [16]	63.0 [15]
Subgrade Modulus (ksi), [CV]	14.9 [20]	15.2 [13]	15.4 [21]	16.4 [18]
August 11, 1999 [63, 75]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [6]	8.1 [7]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1600 [10]	1560 [10]	1630 [10]	1660 [9.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	980 [16]	964 [14]	995 [14]	1053 [14]
Mean Base Modulus (ksi), [CV]	65.5 [18]	61.5 [25]	70.2 [16]	68.9 [22]
Subgrade Modulus (ksi), [CV]	12.9 [20]	12.9 [17]	12.0 [25]	13.7 [14]
May 11, 2000 [64, 51]*				
Average Peak FWD Load (kips), [# tests]	8.7 [3]	5.9 [3]	7.9 [4]	9.7 [4]
Mean Pavement Stiffness (k/in.), [CV]	1490 [12]	1460 [12]	1590 [14]	1660 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	605 [38]	614 [41]	720 [39]	762 [38]
Mean Base Modulus (ksi), [CV]	48.5 [30]	40.0 [13]	46.9 [25]	46.4 [19]
Subgrade Modulus (ksi), [CV]	15.2 [33]	14.7 [7.3]	15.1 [24]	17.0 [16]
September 26, 2000 [59, 53]*				
Average Peak FWD Load (kips), [# tests]	8.9 [6]	No data	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1760 [9.9]		1770 [9.8]	1840 [9.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	809 [17]		756 [15]	817 [15]
Mean Base Modulus (ksi), [CV]	60.6 [28]		69.8 [17]	67.9 [17]
Subgrade Modulus (ksi), [CV]	18.9 [15]		18.4 [7.6]	20.0 [14]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L16: Pavement Structural Condition – Crafco 522, Square Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [60, 48]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.1 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1630 [7.1]		1660 [6.6]	1620 [7.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	648 [26]		694 [21]	579 [21]
Mean Base Modulus (ksi), [CV]	47.1 [23]		47.2 [32]	55.7 [23]
Subgrade Modulus (ksi), [CV]	17.7 [2.5]		17.5 [8.0]	15.9 [34]
October 2, 2001 [33, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [7]	No data	9.0 [3]	11.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1830 [7.9]		1680 [1.9]	1830 [7.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	647 [12]		633 [1.8]	757 [11]
Mean Base Modulus (ksi), [CV]	79.0 [17]		74.0 [3.7]	69.8 [9.3]
Subgrade Modulus (ksi), [CV]	18.5 [19]		15.6 [10]	17.5 [14]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [4]	No data	8.0 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1670 [6.0]		1660 [10]	1680 [9.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	661 [9.9]		702 [11]	660 [8.0]
Mean Base Modulus (ksi), [CV]	45.3 [14]		44.8 [29]	56.8 [34]
Subgrade Modulus (ksi), [CV]	20.9 [15]		18.5 [17]	18.1 [13]
September 4, 2002 [82, 79]*				
Average Peak FWD Load (kips), [# tests]	9.1 [6]	No data	8.2 [4]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1480 [9.6]		1460 [6.1]	1550 [7.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	691 [48]		685 [19]	804 [45]
Mean Base Modulus (ksi), [CV]	93.8 [29]		89.2 [21]	89.5 [47]
Subgrade Modulus (ksi), [CV]	12.7 [23]		13.0 [13]	15.0 [29]
May 13, 2003 [62, 61]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	No data	7.9 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1810 [10]		1840 [12]	1890 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	1030 [33]		1180 [33]	1070 [37]
Mean Base Modulus (ksi), [CV]	43.6 [50]		33.4 [82]	51.2 [39]
Subgrade Modulus (ksi), [CV]	18.2 [69]		14.6 [54]	23.6 [34]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L17: Pavement Structural Condition – Crafco 522, Square Reservoir and Recess

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [66, 80]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	5.7 [6]	7.5 [6]	9.2 [4]
Mean Pavement Stiffness (k/in.), [CV]	1060 [16]	1000 [17]	1070 [16]	1200 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	358 [47]	343 [48]	370 [47]	457 [36]
Mean Base Modulus (ksi), [CV]	43.9 [17]	37.3 [15]	41.6 [15]	47.9 [16]
Subgrade Modulus (ksi), [CV]	12.0 [16]	12.0 [19]	12.9 [18]	13.0 [16]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [5]	5.8 [4]	7.2 [4]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1100 [4.6]	1080 [5.3]	1120 [4.9]	1180 [4.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	270 [9.3]	274 [9.4]	281 [15]	297 [11]
Mean Base Modulus (ksi), [CV]	49.8 [27]	47.7 [18]	54.1 [19]	54.8 [24]
Subgrade Modulus (ksi), [CV]	14.4 [21]	13.7 [5.8]	12.9 [11]	15.3 [13]
August 11, 1999 [63, 75]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [6]	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1230 [9.8]	1190 [11]	1250 [10]	1300 [9.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	432 [21]	418 [22]	444 [22]	474 [19]
Mean Base Modulus (ksi), [CV]	64.9 [15]	61.2 [19]	68.5 [16]	68.8 [17]
Subgrade Modulus (ksi), [CV]	14.4 [21]	13.4 [11]	12.9 [14]	15.9 [27]
May 11, 2000 [64, 52]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.9 [7]	7.9 [7]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1360 [13]	1330 [15]	1380 [14]	1430 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	479 [28]	489 [32]	478 [25]	518 [25]
Mean Base Modulus (ksi), [CV]	49.4 [23]	38.9 [32]	52.1 [24]	51.5 [24]
Subgrade Modulus (ksi), [CV]	13.2 [19]	15.3 [11]	12.6 [17]	14.3 [12]
September 26, 2000 [59, 53]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	8.0 [4]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1280 [11]		1330 [10]	1360 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	368 [36]		395 [27]	391 [25]
Mean Base Modulus (ksi), [CV]	57.8 [36]		62.7 [32]	62.7 [36]
Subgrade Modulus (ksi), [CV]	14.9 [26]		15.2 [13]	16.2 [14]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L17: Pavement Structural Condition – Crafco 522, Square Reservoir and Recess (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [60, 48]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	No data	8.1 [6]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1250 [6.2]		1260 [6.8]	1320 [6.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	302 [27]		327 [24]	335 [25]
Mean Base Modulus (ksi), [CV]	52.4 [18]		49.0 [19]	54.3 [21]
Subgrade Modulus (ksi), [CV]	15.7 [6.4]		15.5 [11]	16.6 [11]
October 2, 2001 [33, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [6]	No data	9.0 [5]	11.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1450 [10]		1480 [11]	1530 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	415 [28]		467 [25]	476 [26]
Mean Base Modulus (ksi), [CV]	76.5 [21]		65.9 [28]	74.1 [26]
Subgrade Modulus (ksi), [CV]	15.3 [6.9]		16.7 [17]	17.4 [12]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	No data	7.9 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1220 [16]		1250 [14]	1280 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	377 [49]		411 [42]	377 [50]
Mean Base Modulus (ksi), [CV]	47.2 [17]		41.7 [16]	56.1 [17]
Subgrade Modulus (ksi), [CV]	14.5 [17]		14.9 [16]	14.9 [18]
September 4, 2002 [85, 83]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	No data	8.1 [5]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1190 [8.7]		1250 [8.7]	1240 [8.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	385 [27]		416 [26]	392 [26]
Mean Base Modulus (ksi), [CV]	94.4 [32]		101 [30]	103 [26]
Subgrade Modulus (ksi), [CV]	12.3 [16]		12.2 [6.2]	12.6 [11]
May 13, 2003 [66, 59]*				
Average Peak FWD Load (kips), [# tests]	8.5 [4]	No data	7.7 [4]	9.8 [4]
Mean Pavement Stiffness (k/in.), [CV]	1430 [17]		1400 [16]	1450 [17]
Mean Asphalt Concrete Modulus (ksi), [CV]	700 [42]		655 [44]	698 [46]
Mean Base Modulus (ksi), [CV]	36.0 [56]		38.3 [55]	40.3 [49]
Subgrade Modulus (ksi), [CV]	16.1 [55]		18.8 [57]	18.6 [41]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L18: Pavement Structural Condition – Crafco 522, Square Reservoir and Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [66, 81]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	5.7 [6]	7.5 [6]	9.2 [6]
Mean Pavement Stiffness (k/in.), [CV]	1290 [8.2]	1260 [8.5]	1320 [8.8]	1360 [8.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	509 [18]	493 [17]	535 [20]	534 [20]
Mean Base Modulus (ksi), [CV]	46.9 [19]	43.2 [26]	45.8 [27]	53.2 [22]
Subgrade Modulus (ksi), [CV]	16.3 [11]	15.5 [11]	16.3 [8.2]	16.9 [14]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.0 [6]	5.7 [6]	7.1 [6]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1340 [12]	1340 [11]	1350 [12]	1410 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	364 [38]	386 [38]	383 [36]	387 [39]
Mean Base Modulus (ksi), [CV]	69.3 [33]	59.8 [39]	62.3 [31]	75.3 [31]
Subgrade Modulus (ksi), [CV]	13.9 [17]	15.3 [17]	16.7 [18]	15.7 [14]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [7.5]	1470 [7.2]	1520 [7.1]	1560 [7.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	647 [27]	655 [25]	693 [27]	705 [24]
Mean Base Modulus (ksi), [CV]	79.0 [31]	73.8 [28]	75.8 [35]	82.0 [27]
Subgrade Modulus (ksi), [CV]	14.8 [18]	14.5 [12]	16.8 [28]	15.8 [13]
May 11, 2000 [73, 55]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.9 [7]	7.9 [8]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1620 [9.2]	1600 [10]	1640 [9.6]	1690 [9.2]
Mean Asphalt Concrete Modulus (ksi), [CV]	726 [28]	738 [32]	789 [28]	814 [27]
Mean Base Modulus (ksi), [CV]	49.4 [38]	43.7 [26]	42.8 [31]	47.2 [36]
Subgrade Modulus (ksi), [CV]	17.1 [14]	17.0 [17]	16.7 [15]	18.5 [4.9]
September 26, 2000 [61, 54]*				
Average Peak FWD Load (kips), [# tests]	8.9 [4]	No data	8.0 [3]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1510 [3.6]		1540 [2.5]	1630 [5.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	546 [24]		604 [22]	627 [17]
Mean Base Modulus (ksi), [CV]	63.1 [16]		65.4 [15]	60.7 [20]
Subgrade Modulus (ksi), [CV]	18.0 [18]		16.4 [4.4]	19.9 [21]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L18: Pavement Structural Condition – Crafco 522, Square Reservoir and Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [62, 49]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	8.0 [3]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1400 [4.4]		1390 [3.4]	1490 [5.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	345 [17]		383 [20]	385 [16]
Mean Base Modulus (ksi), [CV]	61.7 [9.2]		60.0 [19]	63.3 [17]
Subgrade Modulus (ksi), [CV]	16.7 [15]		14.4 [5.7]	18.5 [17]
October 2, 2001 [33, 53]*				
Average Peak FWD Load (kips), [# tests]	10.1 [7]	6.6 [1]	9.0 [6]	11.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1780 [13]	1640 [na]	1770 [11]	1880 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	650 [23]	670 [na]	666 [22]	747 [27]
Mean Base Modulus (ksi), [CV]	68.3 [29]	66.1 [na]	59.1 [34]	69.3 [26]
Subgrade Modulus (ksi), [CV]	19.4 [20]	16.9 [na]	23.1 [20]	19.8 [15]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.7 [6]	No data	8.0 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1350 [7.7]		1380 [7.3]	1400 [7.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	390 [27]		452 [32]	384 [19]
Mean Base Modulus (ksi), [CV]	61.1 [13]		53.0 [31]	70.0 [10]
Subgrade Modulus (ksi), [CV]	14.9 [27]		16.1 [25]	15.0 [23]
September 4, 2002 [81, 87]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	8.1 [2]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1420 [7.2]		1480 [11]	1480 [6.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	454 [17]		574 [15]	543 [22]
Mean Base Modulus (ksi), [CV]	125 [15]		112 [25]	115 [23]
Subgrade Modulus (ksi), [CV]	12.6 [10]		15.3 [0.5]	14.2 [17]
May 13, 2003 [62, 65]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.8 [5]	9.6 [6]
Mean Pavement Stiffness (k/in.), [CV]	1720 [10]		1700 [11]	1740 [8.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	818 [26]		793 [19]	894 [35]
Mean Base Modulus (ksi), [CV]	63.2 [27]		65.6 [39]	55.6 [58]
Subgrade Modulus (ksi), [CV]	15.3 [68]		15.5 [73]	14.7 [74]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L19: Pavement Structural Condition – Crafco 522, Simple Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	Seating Load	Load 1	Load 2	Load 3
September 17, 1998 [67, 83]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	5.7 [6]	7.5 [6]	9.2 [5]
Mean Pavement Stiffness (k/in.), [CV]	1450 [4.1]	1400 [4.7]	1470 [4.4]	1540 [4.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	642 [13]	626 [11]	667 [12]	708 [13]
Mean Base Modulus (ksi), [CV]	60.3 [9.6]	53.9 [19]	60.2 [15]	63.1 [26]
Subgrade Modulus (ksi), [CV]	15.9 [10]	15.7 [12]	15.5 [12]	18.9 [37]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.0 [6]	5.8 [6]	7.2 [6]	9.8 [6]
Mean Pavement Stiffness (k/in.), [CV]	1550 [5.5]	1540 [5.8]	1580 [5.2]	1640 [5.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	641 [26]	659 [26]	668 [26]	659 [21]
Mean Base Modulus (ksi), [CV]	60.8 [19]	52.5 [15]	57.4 [19]	67.9 [13]
Subgrade Modulus (ksi), [CV]	15.4 [14]	15.7 [7.1]	16.2 [8.7]	17.5 [6.8]
August 11, 1999 [65, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [7]	8.2 [7]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1660 [2.9]	1630 [2.8]	1690 [3.0]	1750 [2.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	871 [6.1]	868 [6.6]	904 [9.8]	936 [8.6]
Mean Base Modulus (ksi), [CV]	87.7 [12]	81.5 [16]	90.0 [13]	95.3 [17]
Subgrade Modulus (ksi), [CV]	14.4 [5.2]	14.7 [15]	14.5 [27]	14.8 [7.8]
May 11, 2000 [75, 56]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.9 [5]	7.8 [6]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1680 [13]	1620 [5.1]	1650 [6.1]	1760 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	1019 [18]	1003 [16]	1033 [16]	1097 [14]
Mean Base Modulus (ksi), [CV]	49.5 [22]	43.7 [31]	46.3 [17]	51.0 [21]
Subgrade Modulus (ksi), [CV]	16.9 [10]	15.8 [12]	16.0 [13]	17.0 [10]
September 26, 2000 [63, 55]*				
Average Peak FWD Load (kips), [# tests]	8.9 [4]	5.9 [1]	8.0 [3]	9.8 [4]
Mean Pavement Stiffness (k/in.), [CV]	1840 [5.3]	1710 [na]	1810 [3.1]	1940 [5.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	1001 [4.6]	1007 [na]	1027 [8.1]	1042 [8.2]
Mean Base Modulus (ksi), [CV]	58.1 [10]	55.6 [na]	59.6 [14]	68.3 [13]
Subgrade Modulus (ksi), [CV]	18.8 [19]	17.6 [na]	18.4 [18]	20.1 [6.7]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L19: Pavement Structural Condition – Crafco 522, Simple Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [63, 49]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [1]	8.1 [6]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1460 [13]	1280 [na]	1480 [13]	1500 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	461 [34]	405 [na]	477 [32]	487 [35]
Mean Base Modulus (ksi), [CV]	66.2 [27]	62.1 [na]	65.7 [27]	65.5 [21]
Subgrade Modulus (ksi), [CV]	16.4 [11]	14.6 [na]	16.0 [10]	16.7 [9.0]
October 2, 2001 [33, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [5]	6.5 [2]	9.0 [6]	11.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1810 [18]	1580 [32]	1820 [17]	1880 [17]
Mean Asphalt Concrete Modulus (ksi), [CV]	812 [25]	806 [45]	764 [23]	834 [18]
Mean Base Modulus (ksi), [CV]	79.1 [18]	59.5 [31]	81.0 [15]	78.0 [25]
Subgrade Modulus (ksi), [CV]	19.5 [14]	20.9 [7.1]	19.4 [20]	21.4 [21]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.3 [6]	No data	7.9 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1490 [16]		1520 [12]	1620 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	652 [25]		679 [26]	747 [35]
Mean Base Modulus (ksi), [CV]	38.8 [15]		38.5 [14]	40.3 [26]
Subgrade Modulus (ksi), [CV]	17.3 [23]		18.5 [12]	20.0 [17]
September 4, 2002 [82, 86]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	No data	8.0 [6]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1460 [8.9]		1480 [8.8]	1520 [9.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	693 [31]		761 [25]	735 [27]
Mean Base Modulus (ksi), [CV]	107 [37]		96.6 [36]	116 [22]
Subgrade Modulus (ksi), [CV]	14.5 [47]		15.7 [36]	13.9 [24]
May 13, 2003 [61, 66]*				
Average Peak FWD Load (kips), [# tests]	8.5 [5]	No data	7.8 [4]	9.6 [5]
Mean Pavement Stiffness (k/in.), [CV]	1890 [13]		1940 [12]	1890 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	1110 [46]		1300 [37]	1100 [47]
Mean Base Modulus (ksi), [CV]	64.3 [47]		49.2 [22]	66.5 [44]
Subgrade Modulus (ksi), [CV]	21.6 [40]		11.6 [42]	16.7 [73]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L20: Pavement Structural Condition – Crafco 522, Shallow Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [67, 83]*				
Average Peak FWD Load (kips), [# tests]	8.2 [7]	5.7 [7]	7.5 [7]	9.2 [7]
Mean Pavement Stiffness (k/in.), [CV]	1430 [7.7]	1400 [7.7]	1460 [7.9]	1510 [7.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	524 [18]	536 [17]	552 [17]	542 [16]
Mean Base Modulus (ksi), [CV]	75.7 [18]	66.9 [18]	77.4 [18]	87.0 [18]
Subgrade Modulus (ksi), [CV]	16.9 [9.1]	16.3 [7.8]	16.2 [5.8]	17.2 [7.3]
April 21, 1999 [56, 66]*				
Average Peak FWD Load (kips), [# tests]	8.1 [5]	5.8 [5]	7.3 [4]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1510 [5.9]	1510 [4.7]	1530 [5.9]	1620 [6.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	617 [28]	642 [25]	641 [27]	731 [34]
Mean Base Modulus (ksi), [CV]	70.0 [24]	64.0 [20]	72.0 [18]	74.9 [25]
Subgrade Modulus (ksi), [CV]	13.5 [23]	13.9 [20]	13.1 [15]	13.4 [30]
August 11, 1999 [67, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [7]	8.1 [6]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1760 [5.9]	1740 [5.0]	1760 [3.6]	1850 [5.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	1046 [11]	1036 [8.6]	1097 [7.2]	1129 [7.6]
Mean Base Modulus (ksi), [CV]	96.3 [12]	92.4 [16]	94.1 [11]	100.6 [15]
Subgrade Modulus (ksi), [CV]	13.9 [15]	13.8 [12]	14.0 [19]	15.3 [12]
May 11, 2000 [No data]*				
Average Peak FWD Load (kips), [# tests]	No data	No data	No data	No data
Mean Pavement Stiffness (k/in.), [CV]				
Mean Asphalt Concrete Modulus (ksi), [CV]				
Mean Base Modulus (ksi), [CV]				
Subgrade Modulus (ksi), [CV]				
September 26, 2000 [66, 57]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.9 [1]	8.0 [5]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1830 [4.6]	1750 [na]	1860 [4.8]	1940 [4.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	1042 [8.4]	1118 [na]	1069 [9.6]	1094 [9.7]
Mean Base Modulus (ksi), [CV]	64.5 [17]	60.0 [na]	69.3 [17]	75.7 [16]
Subgrade Modulus (ksi), [CV]	20.9 [8.1]	18.2 [na]	19.5 [9.4]	20.8 [7.7]
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L20: Pavement Structural Condition – Crafco 522, Shallow Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [65, 50]*				
Average Peak FWD Load (kips), [# tests]	9.1 [5]	No data	8.2 [5]	10.1 [4]
Mean Pavement Stiffness (k/in.), [CV]	1740 [19]		1700 [15]	1680 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	679 [25]		686 [25]	689 [19]
Mean Base Modulus (ksi), [CV]	67.5 [17]		65.8 [25]	65.2 [16]
Subgrade Modulus (ksi), [CV]	16.2 [32]		16.1 [21]	15.8 [27]
October 2, 2001 [34, 53]*				
Average Peak FWD Load (kips), [# tests]	No data	6.6 [1]	9.0 [2]	11.1 [2]
Mean Pavement Stiffness (k/in.), [CV]		1850 [na]	1960 [0.8]	2020 [1.7]
Mean Asphalt Concrete Modulus (ksi), [CV]		866 [na]	739 [3.6]	889 [5.2]
Mean Base Modulus (ksi), [CV]		86.6 [na]	89.9 [4.2]	92.6 [5.3]
Subgrade Modulus (ksi), [CV]		17.4 [na]	22.7 [7.5]	22.4 [8.2]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.7 [1]	8.0 [5]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1700 [9.6]	1630 [na]	1710 [7.7]	1820 [6.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	846 [27]	982 [na]	880 [30]	1040 [7.3]
Mean Base Modulus (ksi), [CV]	51.3 [23]	42.4 [na]	52.1 [46]	43.6 [35]
Subgrade Modulus (ksi), [CV]	18.6 [11]	16.1 [na]	17.7 [5.8]	20.0 [7.7]
September 4, 2002 [79, 89]*				
Average Peak FWD Load (kips), [# tests]	8.9 [6]	No data	8.0 [5]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1630 [12]		1620 [8.6]	1680 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	766 [53]		792 [52]	924 [51]
Mean Base Modulus (ksi), [CV]	122 [19]		121 [29]	121 [34]
Subgrade Modulus (ksi), [CV]	15.8 [24]		15.1 [27]	15.8 [21]
May 13, 2003 [57, 66]*				
Average Peak FWD Load (kips), [# tests]	8.7 [4]	No data	7.8 [6]	9.7 [5]
Mean Pavement Stiffness (k/in.), [CV]	2130 [14]		1950 [17]	2050 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	1540 [35]		1390 [40]	1290 [41]
Mean Base Modulus (ksi), [CV]	46.1 [67]		36.5 [73]	51.8 [81]
Subgrade Modulus (ksi), [CV]	20.3 [62]		10.4 [57]	21.0 [55]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L21: Pavement Structural Condition – Maxwell 71, Square Reservoir and Recess

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [70, 88]*				
Average Peak FWD Load (kips), [# tests]	8.0 [7.0]	5.7 [7]	7.4 [7]	9.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1250 [12]	1230 [12]	1310 [12]	1360 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	543 [19]	547 [14]	582 [15]	592 [16]
Mean Base Modulus (ksi), [CV]	47.7 [20]	43.1 [20]	49.7 [17]	53.8 [19]
Subgrade Modulus (ksi), [CV]	16.0 [17]	14.8 [14]	15.3 [20]	17.6 [12]
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [7]	5.8 [7]	7.3 [7]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1480 [9.7]	1440 [10]	1490 [9.6]	1580 [9.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	545 [20]	532 [16]	538 [16]	573 [13]
Mean Base Modulus (ksi), [CV]	56.2 [30]	52.2 [33]	60.0 [28]	65.5 [23]
Subgrade Modulus (ksi), [CV]	17.1 [8.3]	16.8 [13]	16.0 [11]	18.7 [8.3]
August 11, 1999 [68, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.0 [7]	8.1 [7]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1610 [15]	1550 [15]	1640 [15]	1710 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	979 [27]	930 [29]	1030 [29]	1081 [26]
Mean Base Modulus (ksi), [CV]	69.6 [24]	60.8 [23]	68.1 [28]	70.7 [24]
Subgrade Modulus (ksi), [CV]	13.1 [20]	14.4 [29]	13.6 [33]	14.9 [23]
May 11, 2000 [70, 54]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.8 [6]	7.8 [7]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1530 [8.1]	1460 [7.8]	1550 [8.5]	1620 [8.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	657 [20]	597 [20]	671 [23]	720 [25]
Mean Base Modulus (ksi), [CV]	51.9 [40]	47.6 [49]	53.6 [37]	52.8 [45]
Subgrade Modulus (ksi), [CV]	15.8 [13]	15.1 [16]	14.6 [12]	18.4 [19]
September 26, 2000 [62, 55]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	No data	8.0 [4]	9.8 [5]
Mean Pavement Stiffness (k/in.), [CV]	1690 [12]		1680 [14]	1790 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	816 [6.0]		836 [6.7]	857 [4.6]
Mean Base Modulus (ksi), [CV]	48.6 [22]		48.9 [34]	58.3 [32]
Subgrade Modulus (ksi), [CV]	18.4 [16]		18.9 [22]	19.6 [13]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L21: Pavement Structural Condition – Maxwell 71, Square Reservoir and Recess (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [62, 48]*				
Average Peak FWD Load (kips), [# tests]	9.1 [7]	6.0 [2]	8.2 [6]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1530 [9.2]	1290 [12]	1520 [10]	1610 [9.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	484 [19]	503 [32]	504 [20]	535 [20]
Mean Base Modulus (ksi), [CV]	65.0 [18]	39.1 [6.3]	60.2 [16]	66.2 [18]
Subgrade Modulus (ksi), [CV]	16.7 [11]	16.4 [13]	17.6 [11]	18.2 [11]
October 2, 2001 [34, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [5]	6.6 [3]	9.0 [5]	11.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1680 [11]	1500 [7.4]	1700 [11]	1760 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	765 [15]	667 [21]	784 [17]	729 [33]
Mean Base Modulus (ksi), [CV]	53.4 [34]	55.6 [25]	58.0 [39]	65.6 [26]
Subgrade Modulus (ksi), [CV]	20.1 [30]	15.9 [35]	18.0 [30]	20.9 [25]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	8.1 [4]	10.1 [2]
Mean Pavement Stiffness (k/in.), [CV]	1650 [7.5]		1580 [5.5]	1650 [0.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	657 [10]		554 [19]	558 [25]
Mean Base Modulus (ksi), [CV]	57.1 [27]		63.2 [30]	70.8 [39]
Subgrade Modulus (ksi), [CV]	17.2 [21]		17.6 [12]	18.6 [4.6]
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	No data	8.1 [3]	10.1 [7]
Mean Pavement Stiffness (k/in.), [CV]	1490 [12]		1370 [12]	1560 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	490 [27]		425 [27]	536 [29]
Mean Base Modulus (ksi), [CV]	123 [17]		118 [15]	130 [13]
Subgrade Modulus (ksi), [CV]	17.1 [18]		15.2 [15]	17.0 [13]
May 13, 2003 [59, 59]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.8 [6]	9.6 [5]
Mean Pavement Stiffness (k/in.), [CV]	1850 [15]		1820 [16]	1800 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	1010 [40]		1170 [33]	806 [33]
Mean Base Modulus (ksi), [CV]	57.5 [53]		31.6 [78]	76.3 [35]
Subgrade Modulus (ksi), [CV]	17.3 [32]		11.8 [32]	21.2 [43]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L22: Pavement Structural Condition – Maxwell 71, Square Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [70, 89]*				
Average Peak FWD Load (kips), [# tests]	8.1 [5]	5.7 [6]	7.4 [5]	9.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1380 [9.6]	1460 [21]	1420 [8.5]	1580 [21]
Mean Asphalt Concrete Modulus (ksi), [CV]	598 [29]	607 [23]	641 [28]	734 [39]
Mean Base Modulus (ksi), [CV]	64.0 [39]	67.0 [47]	64.5 [37]	62.7 [26]
Subgrade Modulus (ksi), [CV]	17.4 [12]	16.7 [18]	17.3 [16]	20.6 [26]
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [4]	5.8 [4]	7.3 [5]	9.9 [4]
Mean Pavement Stiffness (k/in.), [CV]	1530 [18]	1510 [18]	1540 [16]	1630 [18]
Mean Asphalt Concrete Modulus (ksi), [CV]	455 [24]	484 [22]	522 [31]	487 [20]
Mean Base Modulus (ksi), [CV]	83.1 [27]	71.0 [28]	78.4 [21]	88.7 [22]
Subgrade Modulus (ksi), [CV]	15.1 [13]	15.5 [14]	14.9 [22]	18.0 [16]
August 11, 1999 [67, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.0 [6]	8.1 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1770 [20]	1720 [19]	1790 [20]	1860 [20]
Mean Asphalt Concrete Modulus (ksi), [CV]	943 [27]	924 [23]	964 [21]	971 [17]
Mean Base Modulus (ksi), [CV]	95.9 [31]	90.2 [32]	99.7 [39]	104.9 [27]
Subgrade Modulus (ksi), [CV]	14.1 [28]	13.9 [22]	13.9 [8.5]	15.1 [31]
May 11, 2000 [72, 55]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.8 [5]	7.8 [6]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	1960 [23]	1830 [21]	1880 [22]	2060 [23]
Mean Asphalt Concrete Modulus (ksi), [CV]	1092 [18]	1027 [22]	1143 [19]	1187 [19]
Mean Base Modulus (ksi), [CV]	63.8 [37]	55.9 [44]	52.4 [35]	63.0 [30]
Subgrade Modulus (ksi), [CV]	17.0 [11]	16.2 [7.8]	18.5 [16]	18.2 [22]
September 26, 2000 [61, 54]*				
Average Peak FWD Load (kips), [# tests]	8.8 [4]	5.9 [4]	7.9 [3]	9.8 [3]
Mean Pavement Stiffness (k/in.), [CV]	1670 [5.9]	1630 [6.9]	1650 [1.9]	1720 [2.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	999 [20]	968 [18]	989 [23]	1066 [19]
Mean Base Modulus (ksi), [CV]	49.6 [22]	55.0 [41]	51.4 [35]	52.0 [22]
Subgrade Modulus (ksi), [CV]	20.7 [22]	16.2 [2.5]	17.6 [9.6]	18.6 [6.2]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L22: Pavement Structural Condition – Maxwell 71, Square Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [58, 47]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	6.0 [3]	8.1 [4]	10.1 [6]
Mean Pavement Stiffness (k/in.), [CV]	1660 [7.5]	1570 [3.2]	1610 [2.4]	1810 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	624 [14]	648 [19]	621 [10]	690 [10]
Mean Base Modulus (ksi), [CV]	72.1 [24]	63.2 [35]	68.9 [13]	70.2 [14]
Subgrade Modulus (ksi), [CV]	18.0 [6.4]	18.0 [17]	19.8 [19]	21.0 [18]
October 2, 2001 [34, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [5]	6.6 [4]	9.0 [5]	11.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1920 [8.1]	1820 [3.3]	1930 [8.0]	1920 [3.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	995 [13]	1034 [12]	1012 [15]	1125 [19]
Mean Base Modulus (ksi), [CV]	72.5 [20]	55.7 [27]	72.4 [25]	62.0 [29]
Subgrade Modulus (ksi), [CV]	21.6 [23]	22.4 [20]	21.6 [17]	20.6 [4.4]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.8 [5]	5.4 [2]	8.0 [5]	10.1 [5]
Mean Pavement Stiffness (k/in.), [CV]	1530 [15]	1330 [12]	1570 [10]	1620 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	642 [32]	688 [18]	719 [18]	694 [20]
Mean Base Modulus (ksi), [CV]	61.0 [23]	38.1 [35]	56.2 [45]	64.7 [32]
Subgrade Modulus (ksi), [CV]	17.3 [19]	12.7 [1.1]	16.9 [14]	17.9 [19]
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	8.9 [4]	4.9 [1]	8.1 [3]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1440 [10]	1240 [na]	1440 [7.8]	1490 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	486 [13]	737 [na]	583 [19]	513 [9.3]
Mean Base Modulus (ksi), [CV]	134 [13]	84.3 [na]	127 [16]	142 [7.3]
Subgrade Modulus (ksi), [CV]	15.7 [12]	12.1 [na]	14.4 [22]	16.5 [17]
May 13, 2003 [57, 58]*				
Average Peak FWD Load (kips), [# tests]	8.6 [4]	No data	7.8 [6]	9.7 [6]
Mean Pavement Stiffness (k/in.), [CV]	2040 [23]		2090 [20]	2210 [19]
Mean Asphalt Concrete Modulus (ksi), [CV]	1140 [25]		1230 [33]	1090 [20]
Mean Base Modulus (ksi), [CV]	62.1 [28]		53.5 [58]	78.8 [50]
Subgrade Modulus (ksi), [CV]	27.3 [62]		20.0 [46]	24.9 [53]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L23: Pavement Structural Condition – Maxwell 71, Simple Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [69, 87]*				
Average Peak FWD Load (kips), [# tests]	8.1 [7]	5.7 [7]	7.4 [7]	9.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	1660 [14]	1630 [12]	1710 [13]	1690 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	530 [12]	540 [11]	552 [12]	556 [17]
Mean Base Modulus (ksi), [CV]	98.7 [24]	91.6 [24]	103.6 [24]	96.0 [33]
Subgrade Modulus (ksi), [CV]	16.8 [19]	15.2 [19]	16.2 [18]	21.8 [42]
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.3 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	2070 [9.4]	2050 [9.6]	2100 [9.3]	2200 [9.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	695 [21]	666 [18]	692 [19]	710 [19]
Mean Base Modulus (ksi), [CV]	95.2 [36]	100.5 [17]	99.7 [32]	111.6 [28]
Subgrade Modulus (ksi), [CV]	18.2 [22]	15.6 [8.7]	17.3 [25]	19.9 [23]
August 11, 1999 [66, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [6]	6.1 [6]	8.1 [6]	10.0 [6]
Mean Pavement Stiffness (k/in.), [CV]	2050 [9.3]	2000 [8.2]	2090 [9.0]	2170 [9.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	833 [14]	817 [9.8]	979 [19]	961 [22]
Mean Base Modulus (ksi), [CV]	130.9 [15]	122.0 [14]	106.9 [30]	125.4 [22]
Subgrade Modulus (ksi), [CV]	15.9 [34]	17.1 [34]	26.3 [31]	20.4 [35]
May 11, 2000 [69, 54]*				
Average Peak FWD Load (kips), [# tests]	8.7 [7]	5.8 [8]	7.8 [8]	9.5 [8]
Mean Pavement Stiffness (k/in.), [CV]	1800 [14]	1800 [15]	1860 [14]	1930 [14]
Mean Asphalt Concrete Modulus (ksi), [CV]	847 [40]	829 [39]	906 [35]	937 [33]
Mean Base Modulus (ksi), [CV]	63.8 [19]	67.3 [30]	59.6 [22]	66.7 [25]
Subgrade Modulus (ksi), [CV]	17.3 [12]	16.7 [14]	19.7 [26]	18.6 [14]
September 26, 2000 [No data]*				
Average Peak FWD Load (kips), [# tests]	No data	No data	No data	No data
Mean Pavement Stiffness (k/in.), [CV]				
Mean Asphalt Concrete Modulus (ksi), [CV]				
Mean Base Modulus (ksi), [CV]				
Subgrade Modulus (ksi), [CV]				
continued				

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L23: Pavement Structural Condition – Maxwell 71, Simple Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [59, 47]*				
Average Peak FWD Load (kips), [# tests]	9.0 [3]	No data	8.2 [3]	10.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	1900 [9.7]		1920 [9.8]	1990 [9.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	733 [20]		727 [21]	764 [23]
Mean Base Modulus (ksi), [CV]	67.1 [17]		73.9 [14]	77.6 [15]
Subgrade Modulus (ksi), [CV]	21.4 [9.5]		20.3 [3.6]	21.3 [3.7]
October 2, 2001 [35, 53]*				
Average Peak FWD Load (kips), [# tests]	10.0 [4]	No data	9.0 [3]	11.0 [1]
Mean Pavement Stiffness (k/in.), [CV]	2130 [3.3]		2140 [3.9]	2260 [na]
Mean Asphalt Concrete Modulus (ksi), [CV]	1019 [8.1]		999 [12]	1108 [na]
Mean Base Modulus (ksi), [CV]	81.2 [19]		86.1 [17]	94.0 [na]
Subgrade Modulus (ksi), [CV]	21.8 [11]		20.4 [16]	20.5 [na]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.1 [2]	No data	8.1 [2]	No data
Mean Pavement Stiffness (k/in.), [CV]	2020 [3.1]		2050 [3.0]	
Mean Asphalt Concrete Modulus (ksi), [CV]	835 [13]		979 [8.7]	
Mean Base Modulus (ksi), [CV]	87.8 [9.9]		85.7 [19]	
Subgrade Modulus (ksi), [CV]	19.2 [7.8]		19.8 [3.9]	
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	9.0 [4]	No data	8.0 [3]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1570 [5.9]		1560 [5.7]	1617 [3.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	533 [11]		869 [66]	811 [59]
Mean Base Modulus (ksi), [CV]	142 [9.5]		99.6 [67]	107 [55]
Subgrade Modulus (ksi), [CV]	17.8 [9.2]		21.7 [26]	24.6 [30]
May 13, 2003 [54, 60]*				
Average Peak FWD Load (kips), [# tests]	8.5 [6]	No data	7.7 [5]	9.6 [6]
Mean Pavement Stiffness (k/in.), [CV]	2340 [5.6]		2290 [6.6]	2390 [5.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	1280 [30]		1290 [30]	1310 [20]
Mean Base Modulus (ksi), [CV]	75.3 [53]		51.2 [104]	70.1 [42]
Subgrade Modulus (ksi), [CV]	19.0 [55]		22.9 [64]	19.9 [60]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L24: Pavement Structural Condition – Maxwell 71, Shallow Reservoir and Flush

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [68, 86]*				
Average Peak FWD Load (kips), [# tests]	7.8 [6]	5.7 [6]	7.4 [6]	8.3 [6]
Mean Pavement Stiffness (k/in.), [CV]	1390 [5.0]	1410 [6.5]	1440 [9.4]	1440 [7.8]
Mean Asphalt Concrete Modulus (ksi), [CV]	535 [9.3]	557 [9.4]	567 [13]	558 [15]
Mean Base Modulus (ksi), [CV]	55.9 [22]	52.9 [21]	56.5 [22]	55.6 [28]
Subgrade Modulus (ksi), [CV]	15.2 [23]	15.0 [19]	15.5 [22]	19.1 [45]
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.9 [6]	7.3 [6]	9.9 [5]
Mean Pavement Stiffness (k/in.), [CV]	1720 [6.8]	1690 [5.0]	1720 [4.9]	1810 [6.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	637 [11]	656 [14]	627 [11]	668 [18]
Mean Base Modulus (ksi), [CV]	76.1 [24]	64.0 [29]	76.9 [26]	88.1 [20]
Subgrade Modulus (ksi), [CV]	20.7 [11]	21.6 [11]	21.0 [9.7]	22.8 [11]
August 11, 1999 [66, 76]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [7]	8.1 [7]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1770 [6.3]	1730 [6.5]	1810 [6.2]	1880 [6.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	927 [16]	890 [15]	945 [19]	991 [11]
Mean Base Modulus (ksi), [CV]	89.4 [21]	88.4 [20]	92.7 [26]	95.2 [15]
Subgrade Modulus (ksi), [CV]	15.3 [21]	14.1 [27]	17.0 [31]	17.9 [19]
May 11, 2000 [65, 52]*				
Average Peak FWD Load (kips), [# tests]	8.7 [6]	5.8 [7]	7.8 [7]	9.5 [7]
Mean Pavement Stiffness (k/in.), [CV]	1740 [11]	1790 [17]	1860 [17]	1880 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	756 [18]	762 [19]	828 [22]	876 [17]
Mean Base Modulus (ksi), [CV]	69.5 [24]	64.8 [22]	69.1 [22]	61.4 [30]
Subgrade Modulus (ksi), [CV]	15.7 [22]	15.6 [14]	14.9 [16]	19.1 [34]
September 26, 2000 [64, 56]*				
Average Peak FWD Load (kips), [# tests]	8.6 [4]	No data	7.9 [5]	9.8 [2]
Mean Pavement Stiffness (k/in.), [CV]	1890 [4.0]		1950 [4.3]	2010 [5.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	882 [8.6]		903 [11]	919 [11]
Mean Base Modulus (ksi), [CV]	81.3 [14]		87.6 [11]	84.7 [20]
Subgrade Modulus (ksi), [CV]	19.2 [5.9]		20.0 [12]	20.5 [12]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L24: Pavement Structural Condition – Maxwell 71, Shallow Reservoir and Flush (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [59, 47]*				
Average Peak FWD Load (kips), [# tests]	9.0 [4]	No data	8.1 [5]	10.0 [4]
Mean Pavement Stiffness (k/in.), [CV]	1850 [13]		1880 [11]	1910 [9.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	640 [24]		665 [21]	668 [17]
Mean Base Modulus (ksi), [CV]	81.1 [18]		81.9 [11]	83.7 [16]
Subgrade Modulus (ksi), [CV]	20.5 [11]		20.9 [14]	20.9 [5.1]
October 2, 2001 [36, 54]*				
Average Peak FWD Load (kips), [# tests]	10.0 [4]	6.6 [1]	9.0 [3]	11.0 [3]
Mean Pavement Stiffness (k/in.), [CV]	2050 [5.9]	1880 [na]	2080 [6.3]	2180 [6.0]
Mean Asphalt Concrete Modulus (ksi), [CV]	978 [13]	1047 [na]	993 [7.0]	1081 [8.7]
Mean Base Modulus (ksi), [CV]	86.7 [16]	62.5 [na]	94.8 [8.7]	94.1 [2.2]
Subgrade Modulus (ksi), [CV]	20.2 [14]	19.9 [na]	19.8 [6.6]	21.3 [8.2]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.1 [5]	No data	8.2 [4]	10.2 [3]
Mean Pavement Stiffness (k/in.), [CV]	1820 [11]		1890 [5.0]	1920 [4.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	670 [38]		718 [12]	780 [10]
Mean Base Modulus (ksi), [CV]	68.3 [23]		76.1 [12]	66.5 [23]
Subgrade Modulus (ksi), [CV]	23.3 [13]		21.5 [4.6]	24.1 [3.4]
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	8.9 [3]	No data	8.0 [1]	10.1 [3]
Mean Pavement Stiffness (k/in.), [CV]	1690 [19]		1550 [na]	1720 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	798 [79]		500 [na]	619 [34]
Mean Base Modulus (ksi), [CV]	119 [44]		150 [na]	142 [6.2]
Subgrade Modulus (ksi), [CV]	18.5 [36]		14.2 [na]	23.7 [29]
May 13, 2003 [54, 63]*				
Average Peak FWD Load (kips), [# tests]	8.6 [6]	No data	7.7 [4]	9.6 [7]
Mean Pavement Stiffness (k/in.), [CV]	2150 [7.2]		2080 [7.9]	2180 [6.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	1300 [24]		1410 [29]	1290 [26]
Mean Base Modulus (ksi), [CV]	30.2 [100]		28.3 [94]	33.2 [80]
Subgrade Modulus (ksi), [CV]	13.2 [81]		10.3 [30]	17.3 [75]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L25: Pavement Structural Condition – Maxwell 71, Square Reservoir and Band-Aid

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [68, 86]*				
Average Peak FWD Load (kips), [# tests]	8.0 [1]	5.7 [1]	7.4 [1]	No data
Mean Pavement Stiffness (k/in.), [CV]	1090 [na]	1130 [na]	1200 [na]	
Mean Asphalt Concrete Modulus (ksi), [CV]	286 [na]	316 [na]	333 [na]	
Mean Base Modulus (ksi), [CV]	71.8 [na]	64.1 [na]	71.8 [na]	
Subgrade Modulus (ksi), [CV]	12.6 [na]	13.7 [na]	13.8 [na]	
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [6]	7.3 [6]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1850 [15]	1830 [14]	1880 [15]	1980 [16]
Mean Asphalt Concrete Modulus (ksi), [CV]	568 [32]	570 [26]	591 [29]	591 [28]
Mean Base Modulus (ksi), [CV]	95.2 [20]	90.9 [13]	93.5 [16]	106.1 [20]
Subgrade Modulus (ksi), [CV]	16.9 [21]	15.9 [23]	17.4 [24]	18.7 [16]
August 11, 1999 [66, 76]*				
Average Peak FWD Load (kips), [# tests]	8.9 [7]	6.0 [7]	8.1 [7]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1610 [14]	1610 [13]	1670 [12]	1720 [12]
Mean Asphalt Concrete Modulus (ksi), [CV]	733 [19]	756 [13]	1012 [64]	820 [13]
Mean Base Modulus (ksi), [CV]	84.3 [38]	90.7 [47]	73.8 [57]	94.1 [44]
Subgrade Modulus (ksi), [CV]	18.0 [58]	12.6 [27]	14.9 [31]	14.8 [40]
May 11, 2000 [63, 51]*				
Average Peak FWD Load (kips), [# tests]	8.6 [1]	5.7 [1]	7.7 [1]	9.5 [1]
Mean Pavement Stiffness (k/in.), [CV]	1560 [na]	1530 [na]	1590 [na]	1650 [na]
Mean Asphalt Concrete Modulus (ksi), [CV]	614 [na]	603 [na]	647 [na]	607 [na]
Mean Base Modulus (ksi), [CV]	54.1 [na]	56.1 [na]	37.6 [na]	68.5 [na]
Subgrade Modulus (ksi), [CV]	16.7 [na]	13.9 [na]	28.2 [na]	16.9 [na]
September 26, 2000 [67, 57]*				
Average Peak FWD Load (kips), [# tests]	8.8 [2]	No data	7.9 [3]	9.6 [2]
Mean Pavement Stiffness (k/in.), [CV]	1760 [8.4]		1760 [7.3]	1770 [3.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	873 [3.7]		862 [0.6]	953 [5.7]
Mean Base Modulus (ksi), [CV]	71.8 [21]		76.7 [11]	69.7 [9.3]
Subgrade Modulus (ksi), [CV]	16.3 [1.7]		16.1 [16]	17.8 [23]

continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L25: Pavement Structural Condition – Maxwell 71, Square Reservoir and Band-Aid (cont'd)

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [53, 44]*				
Average Peak FWD Load (kips), [# tests]	9.0 [5]	No data	8.0 [2]	9.9 [4]
Mean Pavement Stiffness (k/in.), [CV]	1670 [18]		1380 [1.9]	1690 [18]
Mean Asphalt Concrete Modulus (ksi), [CV]	452 [33]		331 [10]	453 [32]
Mean Base Modulus (ksi), [CV]	80.1 [16]		66.6 [30]	82.6 [18]
Subgrade Modulus (ksi), [CV]	17.7 [12]		16.8 [11]	17.5 [12]
October 2, 2001 [37, 54]*				
Average Peak FWD Load (kips), [# tests]	9.9 [3]	6.5 [2]	8.9 [2]	11.0 [1]
Mean Pavement Stiffness (k/in.), [CV]	1940 [7.1]	1730 [3.2]	1890 [4.6]	1900 [na]
Mean Asphalt Concrete Modulus (ksi), [CV]	906 [20]	688 [17]	814 [3.1]	844 [na]
Mean Base Modulus (ksi), [CV]	81.8 [4.6]	89.7 [15]	91.9 [11]	88.4 [na]
Subgrade Modulus (ksi), [CV]	15.3 [30]	17.1 [13]	14.7 [15]	18.2 [na]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	8.9 [4]	No data	8.1 [4]	10.2 [4]
Mean Pavement Stiffness (k/in.), [CV]	1750 [6.5]		1770 [7.2]	1840 [7.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	705 [21]		715 [19]	726 [19]
Mean Base Modulus (ksi), [CV]	71.4 [15]		73.3 [16]	76.4 [17]
Subgrade Modulus (ksi), [CV]	17.7 [13]		17.8 [9.2]	19.9 [12]
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	8.9 [5]	No data	7.9 [4]	10.0 [5]
Mean Pavement Stiffness (k/in.), [CV]	1460 [12]		1490 [4.9]	1500 [7.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	508 [31]		736 [72]	906 [63]
Mean Base Modulus (ksi), [CV]	122 [23]		105 [56]	80.1 [70]
Subgrade Modulus (ksi), [CV]	15.9 [23]		17.9 [39]	21.2 [37]
May 13, 2003 [61, 61]*				
Average Peak FWD Load (kips), [# tests]	8.5 [5]	No data	7.7 [6]	9.6 [5]
Mean Pavement Stiffness (k/in.), [CV]	1950 [16]		1930 [14]	2060 [13]
Mean Asphalt Concrete Modulus (ksi), [CV]	1070 [52]		1230 [43]	945 [19]
Mean Base Modulus (ksi), [CV]	66.6 [50]		43.5 [68]	88.1 [22]
Subgrade Modulus (ksi), [CV]	23.8 [14]		14.7 [31]	27.6 [33]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Table L26: Pavement Structural Condition - Control

Assumed AC Thickness = 8.1 in. *Assumed Base Thickness = 24.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
September 17, 1998 [69, 88]*				
Average Peak FWD Load (kips), [# tests]	7.1 [7]	5.6 [7]	7.3 [6]	7.6 [6]
Mean Pavement Stiffness (k/in.), [CV]	1060 [9.1]	1150 [12]	1130 [12]	1250 [6.6]
Mean Asphalt Concrete Modulus (ksi), [CV]	539 [28]	584 [26]	597 [24]	671 [21]
Mean Base Modulus (ksi), [CV]	28.5 [32]	28.5 [31]	29.1 [28]	33.6 [28]
Subgrade Modulus (ksi), [CV]	9.5 [37]	11.9 [25]	11.5 [25]	13.6 [8.6]
April 21, 1999 [55, 64]*				
Average Peak FWD Load (kips), [# tests]	8.1 [6]	5.8 [7]	7.3 [7]	9.9 [6]
Mean Pavement Stiffness (k/in.), [CV]	1450 [10]	1410 [9.7]	1460 [9.2]	1560 [9.7]
Mean Asphalt Concrete Modulus (ksi), [CV]	575 [23]	553 [21]	568 [19]	635 [22]
Mean Base Modulus (ksi), [CV]	35.9 [16]	34.6 [28]	37.9 [21]	39.3 [22]
Subgrade Modulus (ksi), [CV]	11.9 [19]	11.1 [31]	11.2 [29]	13.8 [13]
August 11, 1999 [68, 77]*				
Average Peak FWD Load (kips), [# tests]	9.0 [7]	6.1 [7]	8.1 [7]	9.9 [7]
Mean Pavement Stiffness (k/in.), [CV]	1500 [7.8]	1450 [8.7]	1520 [7.6]	1590 [7.5]
Mean Asphalt Concrete Modulus (ksi), [CV]	974 [12]	911 [16]	1019 [15]	1051 [13]
Mean Base Modulus (ksi), [CV]	38.6 [13]	37.2 [13]	38.1 [19]	42.5 [16]
Subgrade Modulus (ksi), [CV]	12.0 [31]	12.2 [29]	12.0 [23]	11.7 [18]
May 11, 2000 [65, 52]*				
Average Peak FWD Load (kips), [# tests]	8.7 [5]	5.8 [6]	7.8 [6]	9.5 [4]
Mean Pavement Stiffness (k/in.), [CV]	1480 [10]	1420 [10]	1490 [9.4]	1480 [4.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	748 [32]	715 [28]	794 [27]	750 [31]
Mean Base Modulus (ksi), [CV]	26.4 [23]	34.6 [36]	36.2 [42]	30.0 [36]
Subgrade Modulus (ksi), [CV]	11.0 [13]	10.6 [23]	10.6 [15]	9.8 [13]
September 26, 2000 [71, 58]*				
Average Peak FWD Load (kips), [# tests]	8.4 [4]	No data	7.9 [5]	9.7 [5]
Mean Pavement Stiffness (k/in.), [CV]	1370 [12]		1430 [9.3]	1550 [10]
Mean Asphalt Concrete Modulus (ksi), [CV]	574 [28]		627 [24]	678 [26]
Mean Base Modulus (ksi), [CV]	44.7 [46]		43.6 [51]	48.8 [48]
Subgrade Modulus (ksi), [CV]	14.0 [23]		14.0 [25]	15.1 [22]

Continued

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is “corrected” to a temperature of 77 ºF by the ADAP software.

Table L26: Pavement Structural Condition – Control (cont'd)

Assumed AC Thickness = 8.1 in. / *Assumed Base Thickness = 15.0 in.*	**Seating Load**	**Load 1**	**Load 2**	**Load 3**
April 10, 2001 [55, 45]*				
Average Peak FWD Load (kips), [# tests]	9.0 [8]	No data	8.1 [4]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1470 [7.1]		1510 [8.9]	1560 [7.3]
Mean Asphalt Concrete Modulus (ksi), [CV]	502 [24]		526 [29]	542 [24]
Mean Base Modulus (ksi), [CV]	36.2 [46]		44.4 [45]	38.9 [43]
Subgrade Modulus (ksi), [CV]	14.0 [16]		14.5 [13]	15.2 [12]
October 2, 2001 [38, 55]*				
Average Peak FWD Load (kips), [# tests]	10.0 [7]	No data	9.0 [7]	11.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1710 [9.9]		1720 [9.6]	1810 [8.9]
Mean Asphalt Concrete Modulus (ksi), [CV]	816 [19]		807 [19]	853 [19]
Mean Base Modulus (ksi), [CV]	40.2 [18]		43.3 [12]	47.9 [20]
Subgrade Modulus (ksi), [CV]	15.1 [22]		14.3 [21]	15.3 [17]
April 29, 2002 [55, 49]*				
Average Peak FWD Load (kips), [# tests]	9.1 [5]	No data	8.1 [4]	10.2 [6]
Mean Pavement Stiffness (k/in.), [CV]	1420 [9.0]		1460 [8.0]	1470 [8.4]
Mean Asphalt Concrete Modulus (ksi), [CV]	482 [28]		600 [19]	469 [30]
Mean Base Modulus (ksi), [CV]	39.4 [29]		29.0 [25]	44.8 [27]
Subgrade Modulus (ksi), [CV]	11.4 [35]		14.9 [43]	13.8 [43]
September 4, 2002 [78, 90]*				
Average Peak FWD Load (kips), [# tests]	8.8 [6]	7.4 [1]	7.9 [4]	10.0 [7]
Mean Pavement Stiffness (k/in.), [CV]	1300 [5.4]	1260 [na]	1300 [7.4]	1380 [5.1]
Mean Asphalt Concrete Modulus (ksi), [CV]	517 [24]	512 [na]	573 [6.5]	563 [14]
Mean Base Modulus (ksi), [CV]	72.4 [29]	61.1 [na]	59.9 [16]	75.3 [27]
Subgrade Modulus (ksi), [CV]	9.4 [18]	8.7 [na]	9.3 [5.5]	10.5 [9.2]
May 13, 2003 [66, 56]*				
Average Peak FWD Load (kips), [# tests]	8.6 [4]	No data	7.7 [3]	9.6 [3]
Mean Pavement Stiffness (k/in.), [CV]	1650 [10]		1580 [11]	1650 [11]
Mean Asphalt Concrete Modulus (ksi), [CV]	680 [14]		716 [25]	683 [15]
Mean Base Modulus (ksi), [CV]	52.1 [37]		40.7 [13]	57.2 [44]
Subgrade Modulus (ksi), [CV]	25.3 [19]		25.7 [14]	24.4 [23]

* [surface temperature (ºF), mat temperature (ºF)]
[# tests] = number of FWD test stations (one test per station), [CV] = coefficient of variation (%)
Notes: All results were reduced from data obtained by a Jils falling-weight deflectometer. Loads were applied in the order shown. Asphalt concrete modulus is "corrected" to a temperature of 77 ºF by the ADAP software.

Appendix M
Eclectic Forecasting Results for the Helena Site

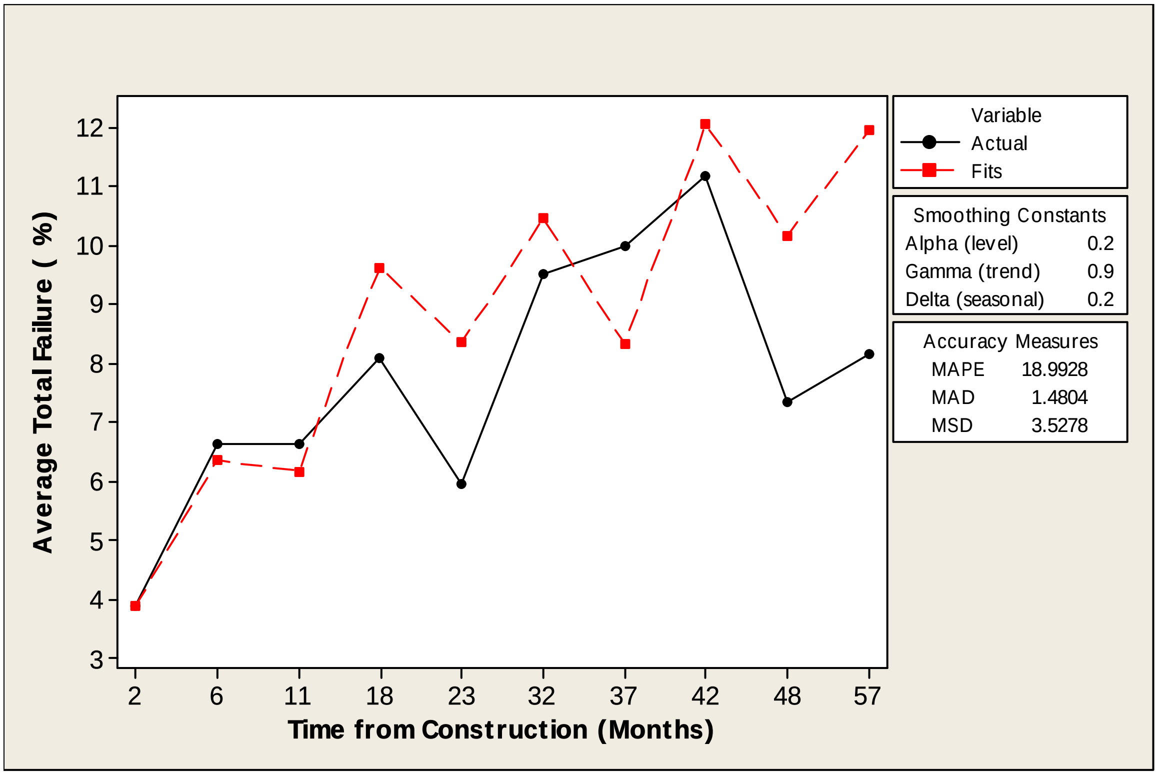

Figure 1: Winter's Seasonal Exponential Smoothing for Crafco 231, SH-F

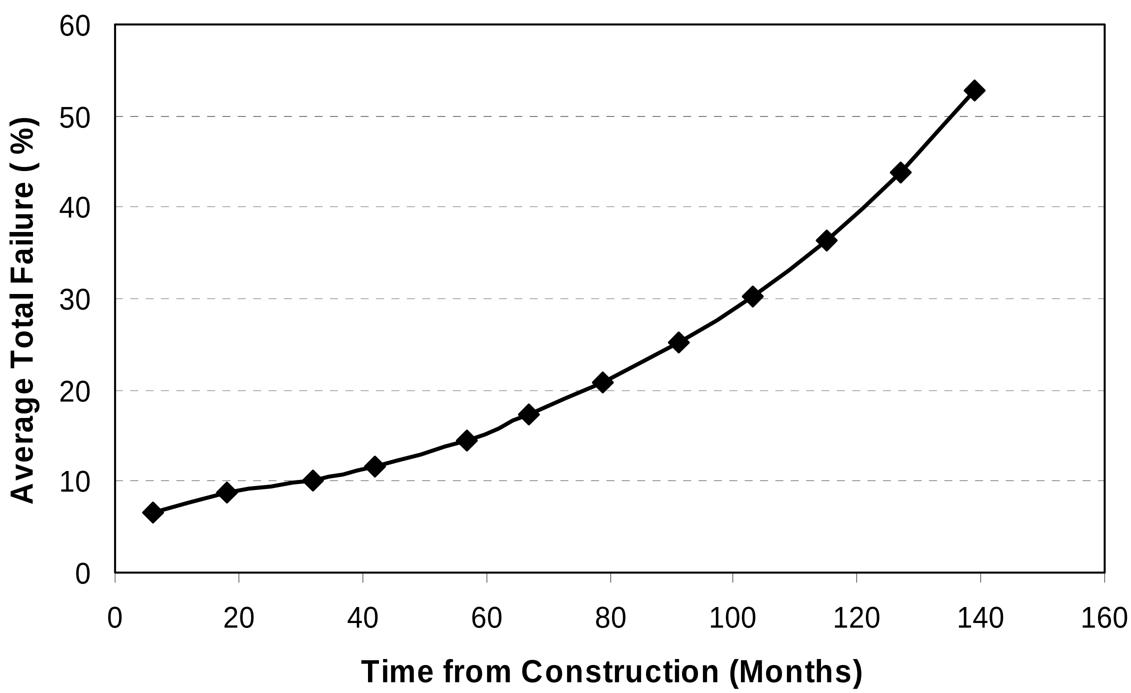

Figure 2: Eclectic Forecasting Results for Crafco 231, SH-F

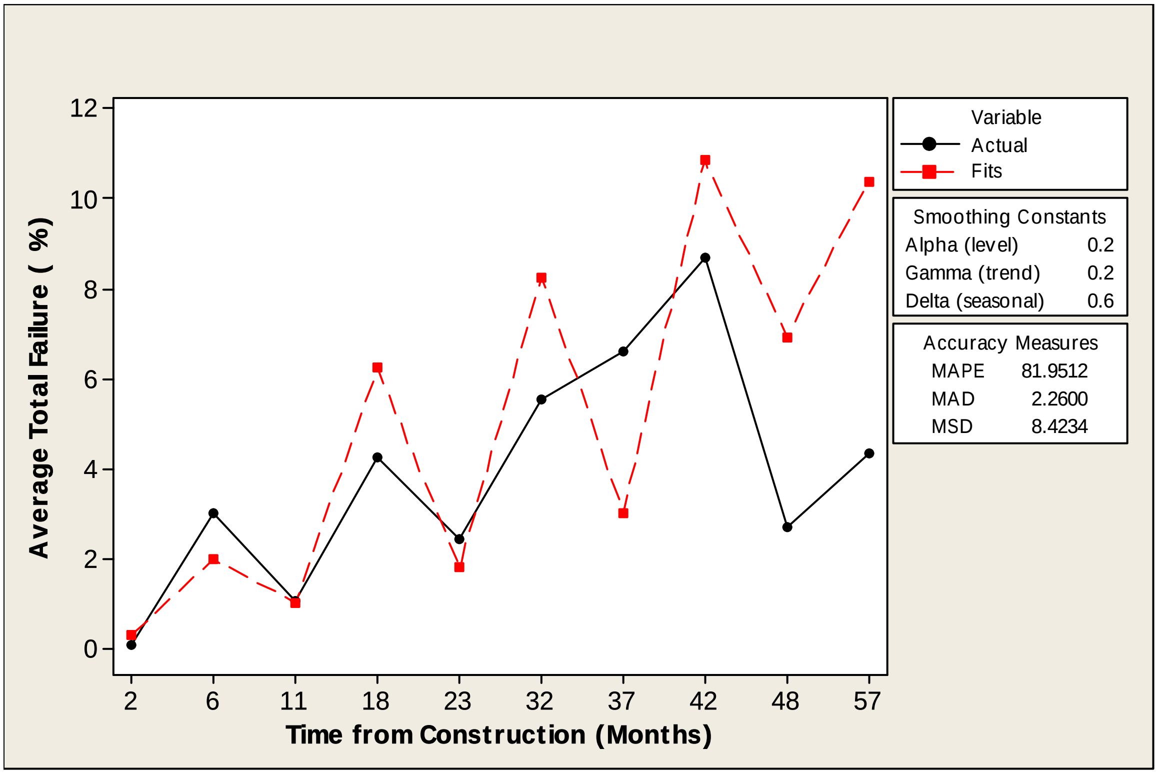

Figure 3: Winter's Seasonal Exponential Smoothing for Crafco 231, SQ-BA

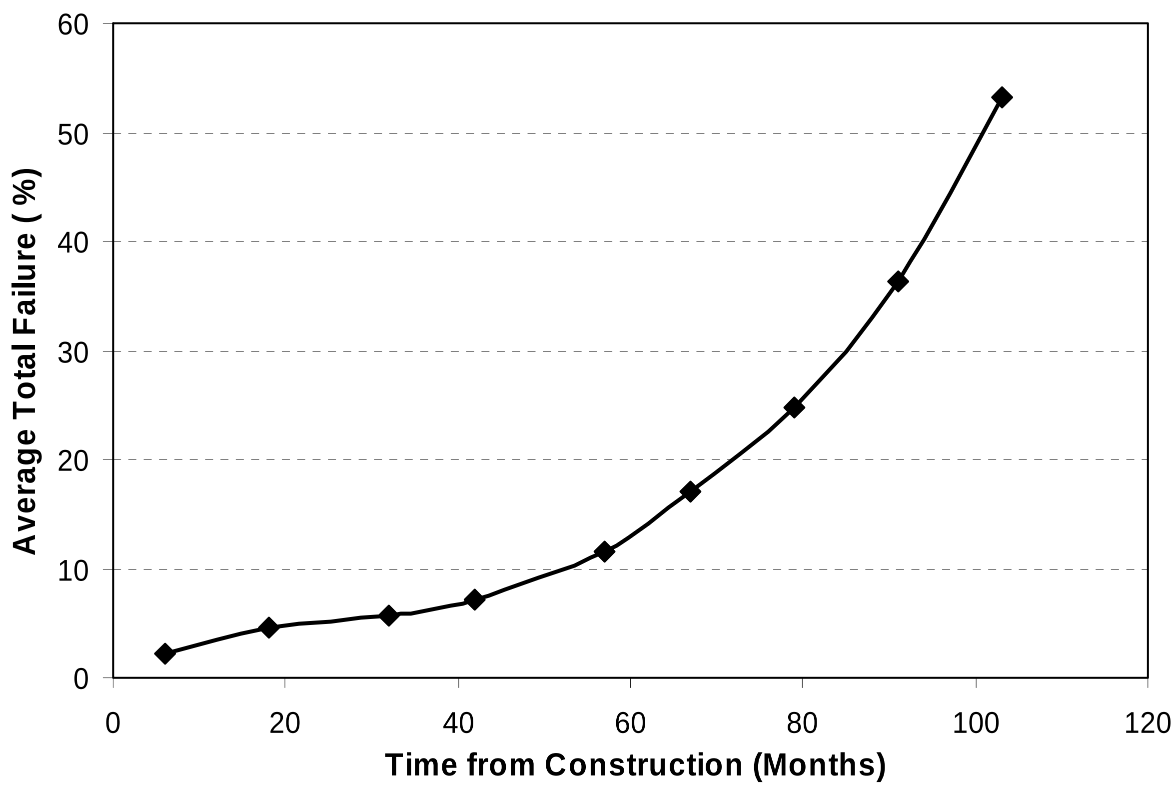

Figure 4: Eclectic Forecasting Results for Crafco 231, SQ-BA

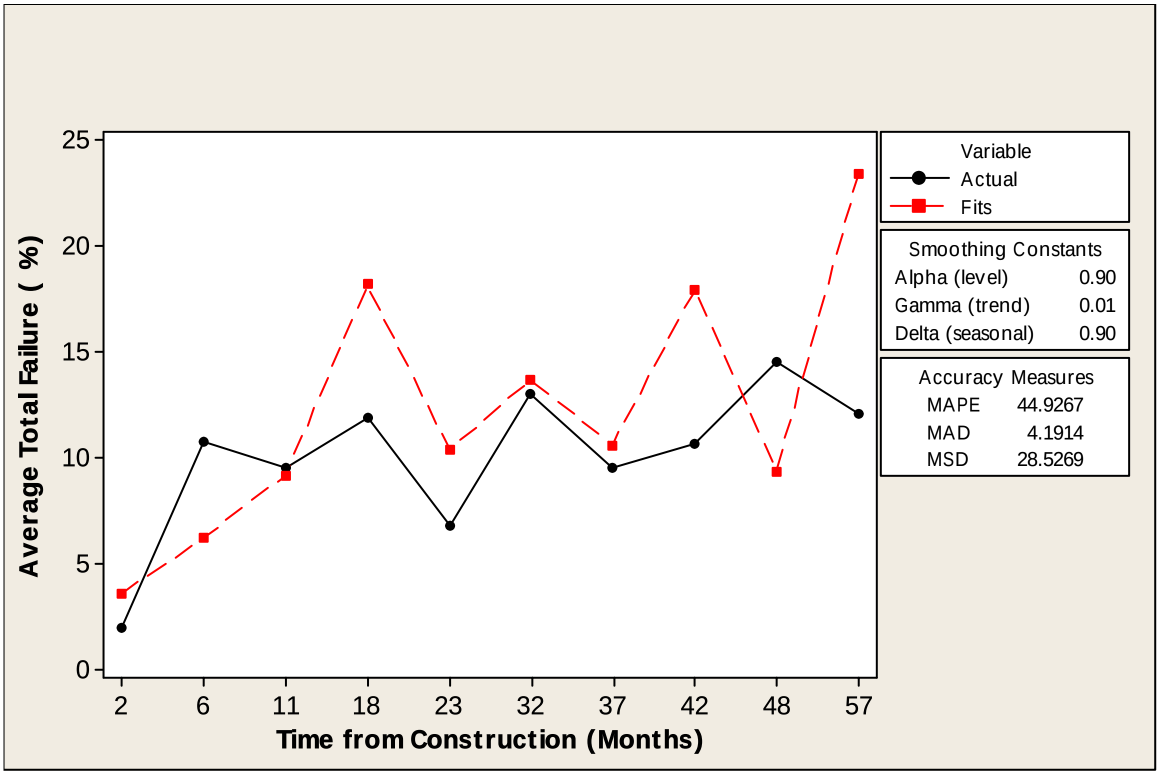

Figure 5: Winter's Seasonal Exponential Smoothing for Crafco 231, SQ-F

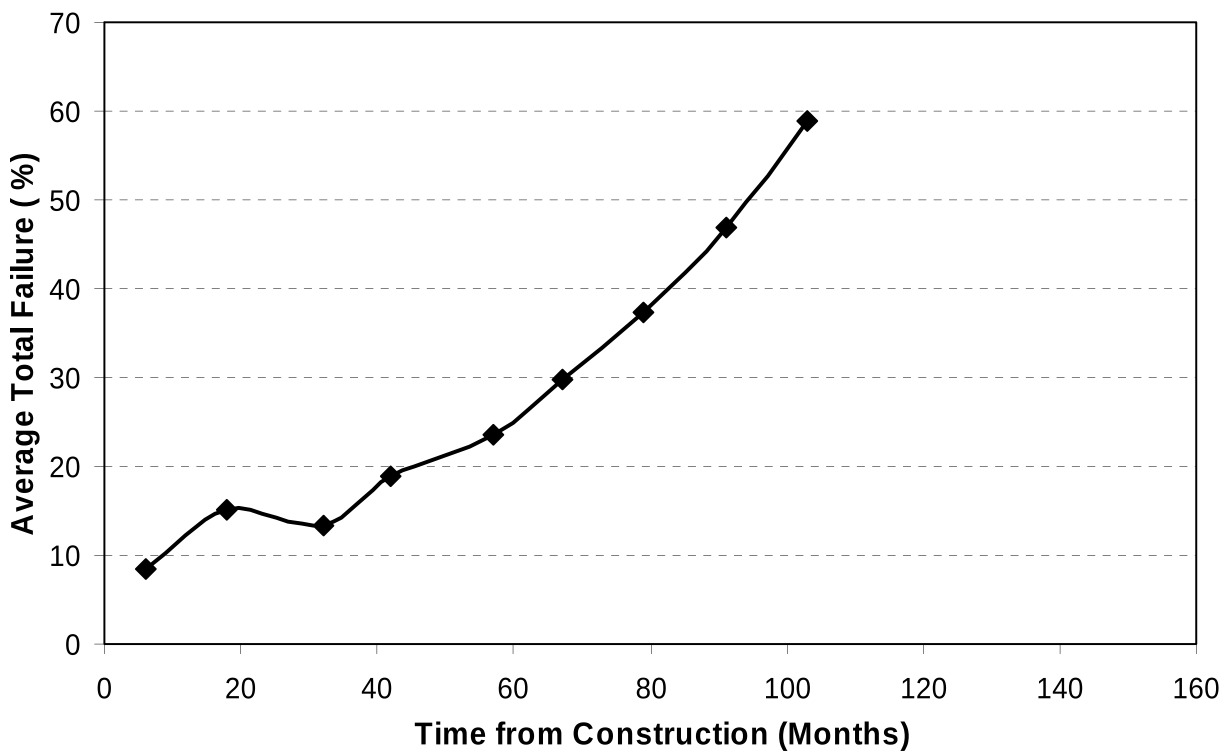

Figure 6: Eclectic Forecasting Results for Crafco 231, SQ-F

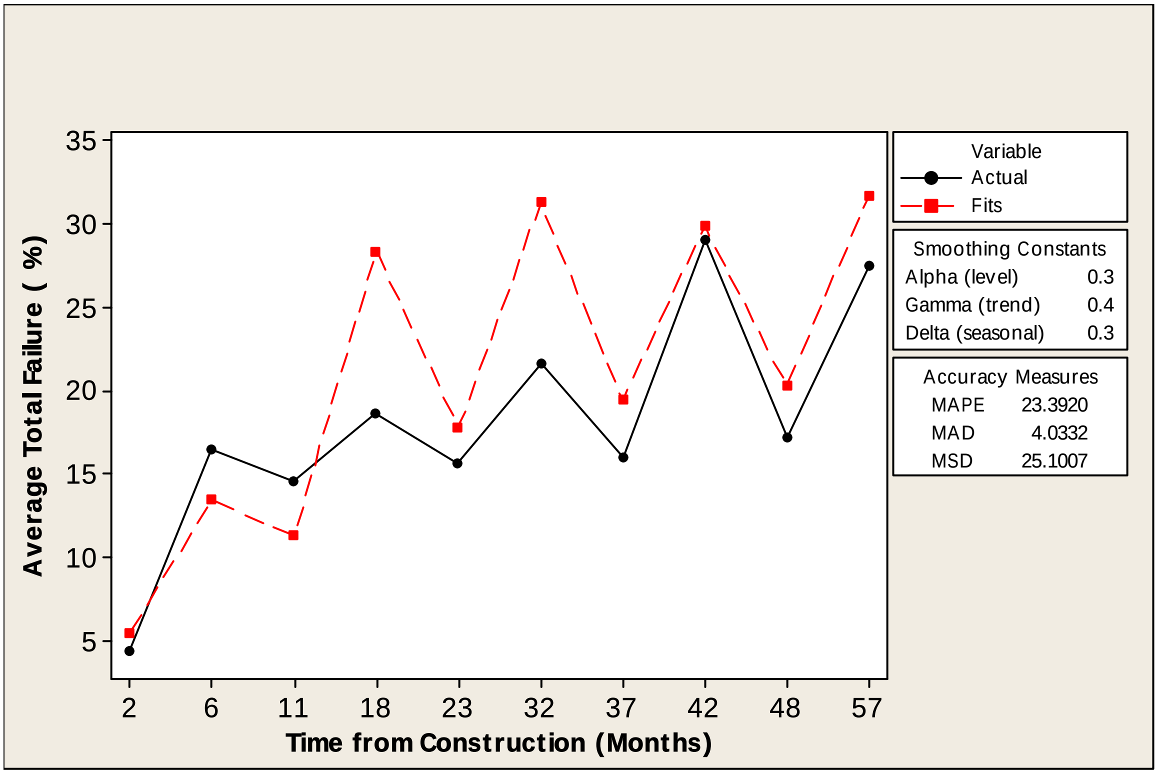

Figure 7: Winter's Seasonal Exponential Smoothing for Crafco 231, SQ-R

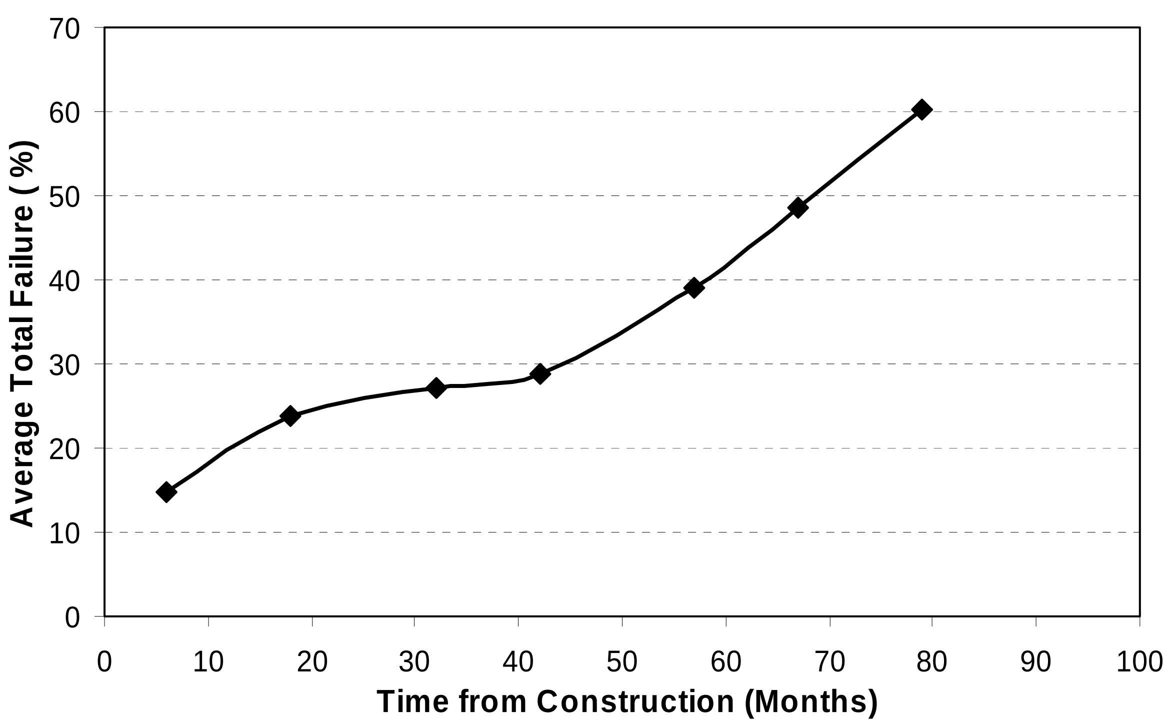

Figure 8: Eclectic Forecasting Results for Crafco 231, SQ-R

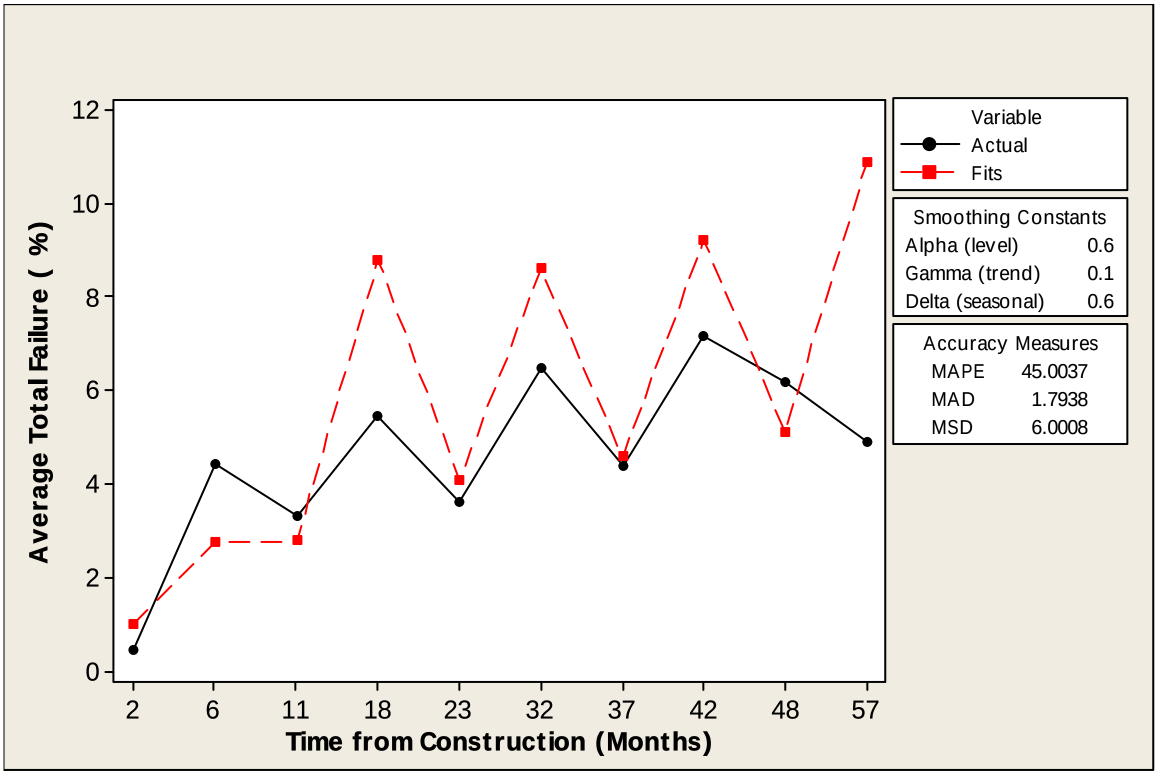

Figure 9: Winter's Seasonal Exponential Smoothing for Maxwell 72, SH-F

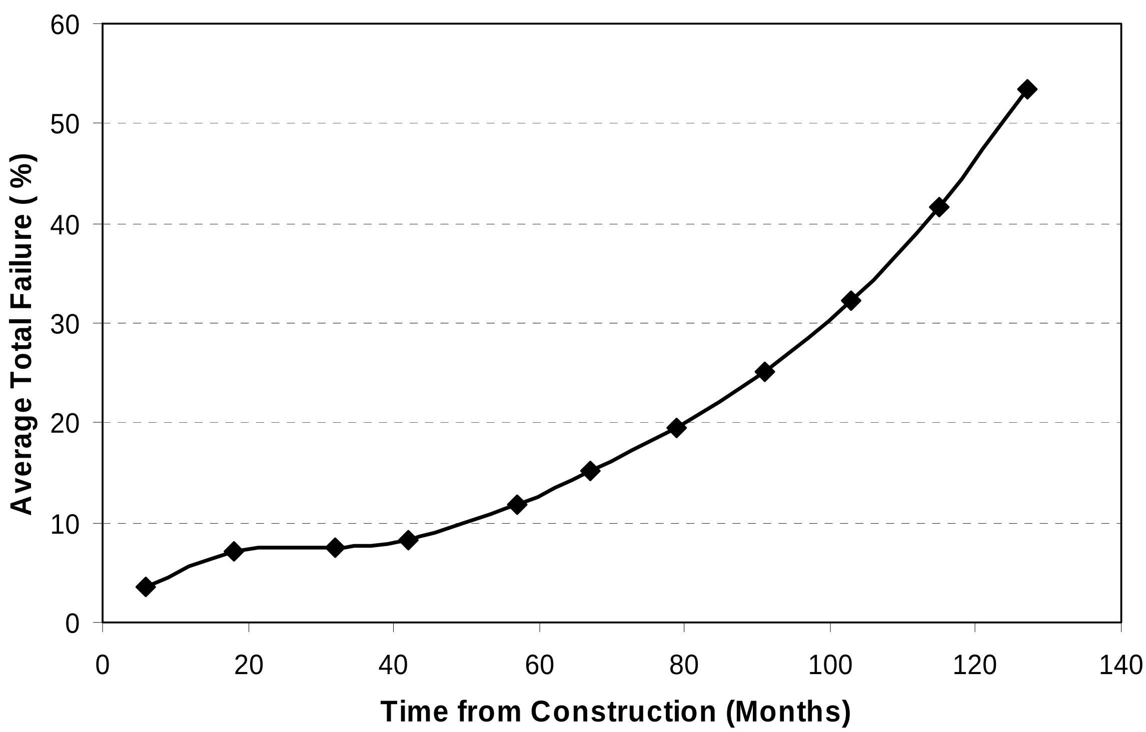

Figure 10: Eclectic Forecasting Results for Maxwell 72, SH-F

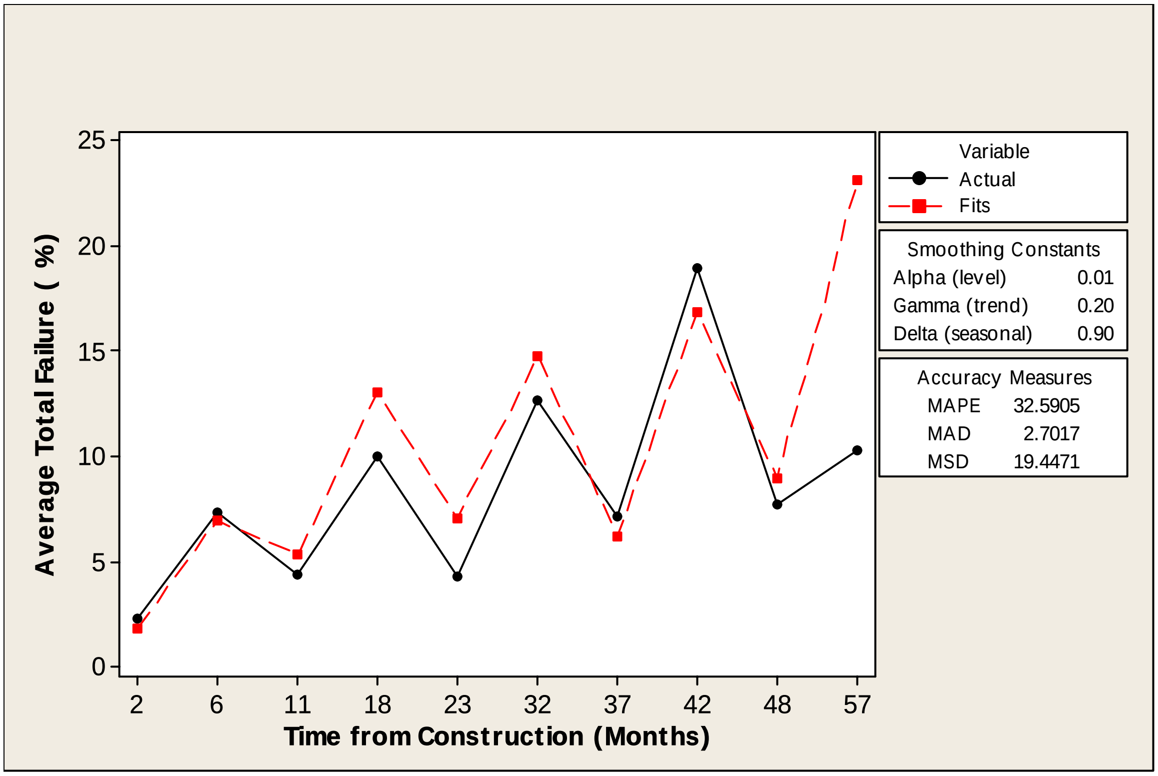

Figure 11: Winter's Seasonal Exponential Smoothing for Maxwell 72, SQ-F

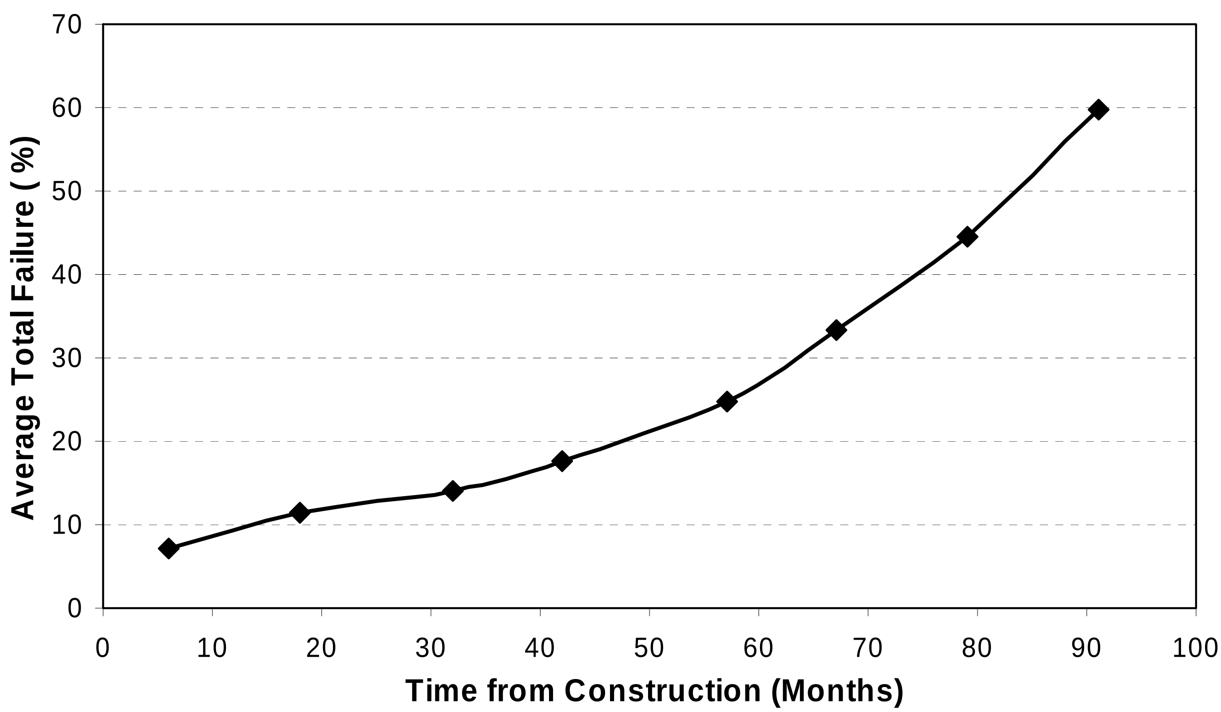

Figure 12: Eclectic Forecasting Results for Maxwell 72, SQ-F

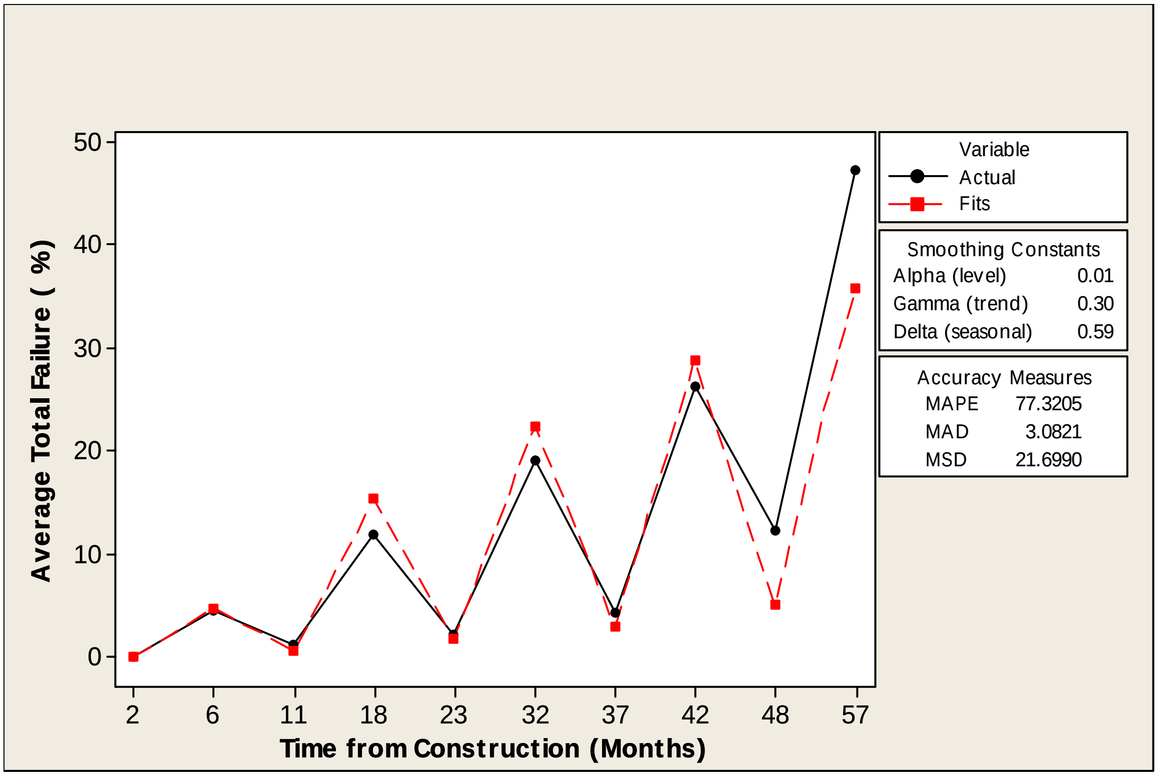

Figure 13: Winter's Seasonal Exponential Smoothing for Crafco 522, BA

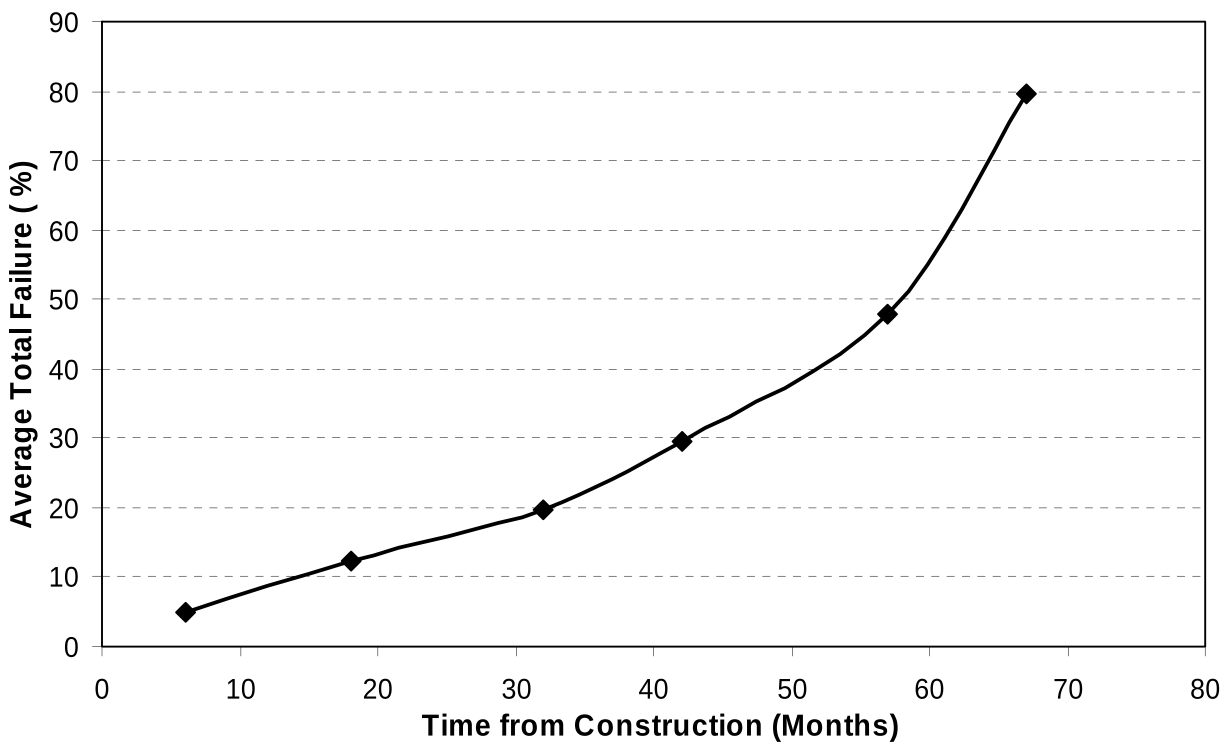

Figure 14: Eclectic Forecasting Results for Crafco 522, BA

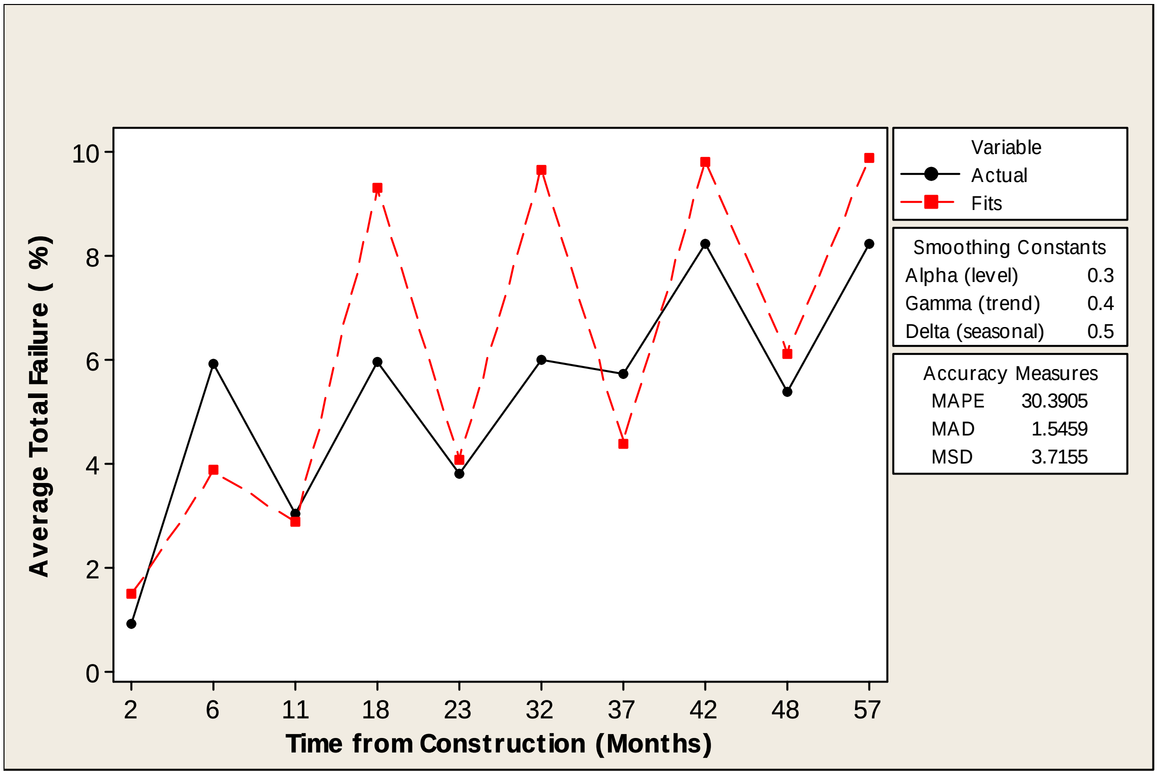

Figure 15: Winter's Seasonal Exponential Smoothing for Crafco 522, SH-F

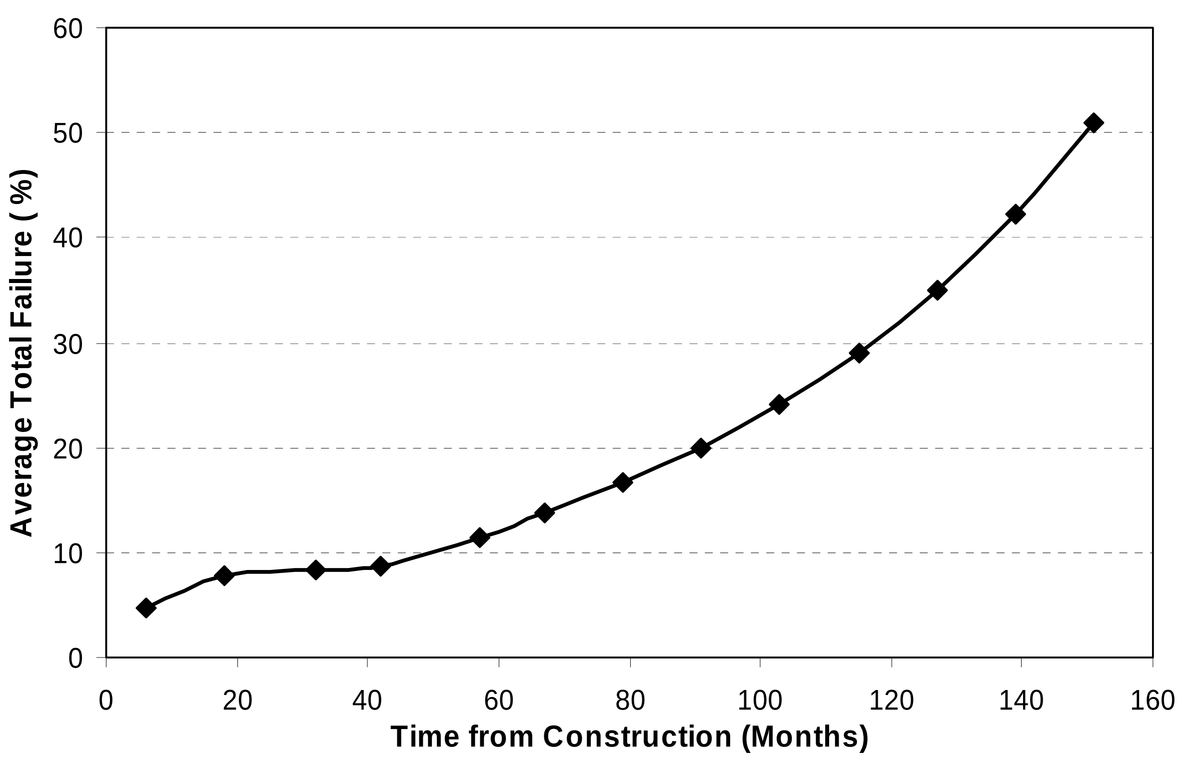

Figure 16: Eclectic Forecasting Results for Crafco 522, SH-F

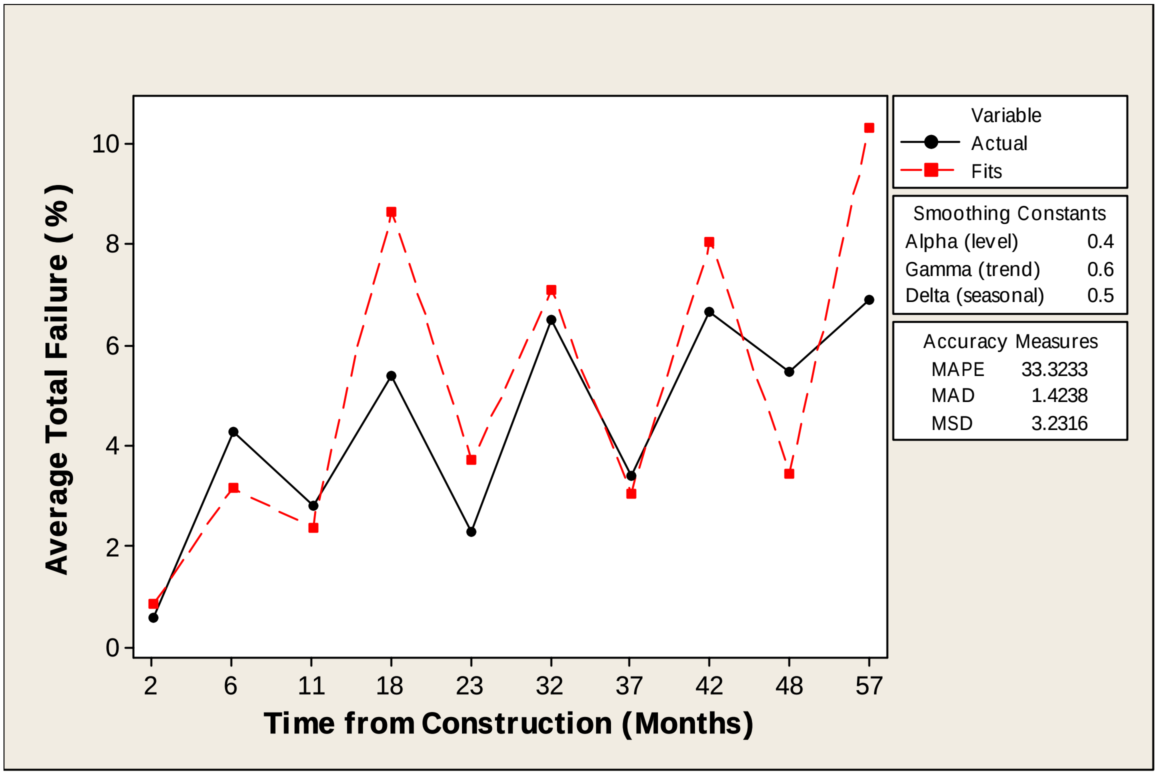

Figure 17: Winter's Seasonal Exponential Smoothing for Crafco 522, SQ-BA

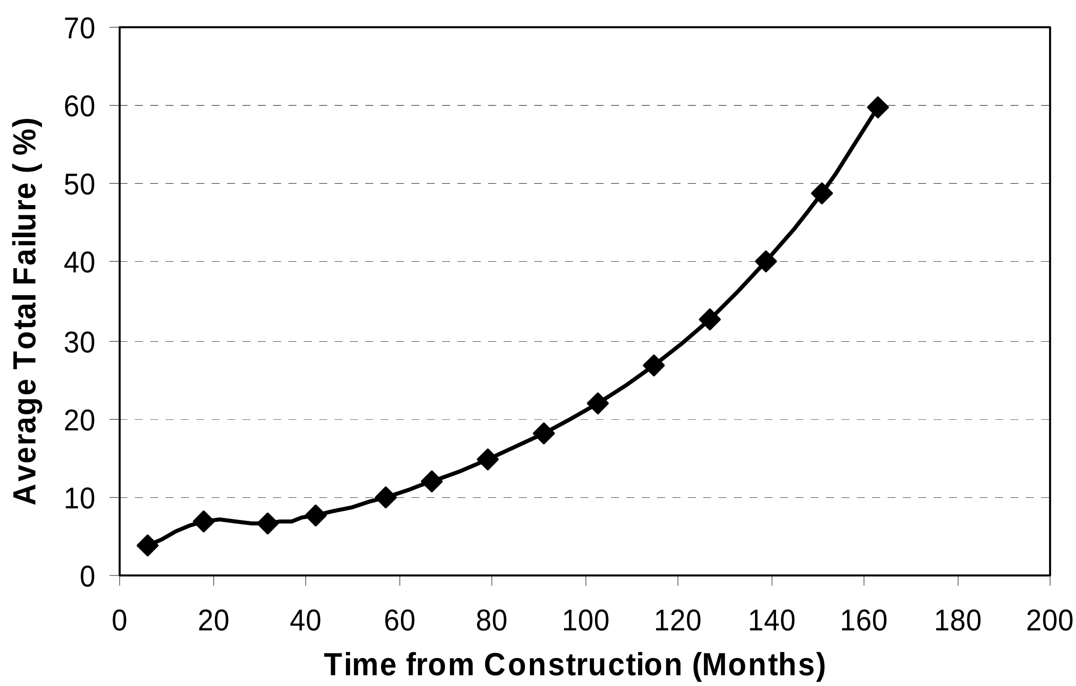

Figure 18: Eclectic Forecasting Results for Crafco 522, SQ-BA

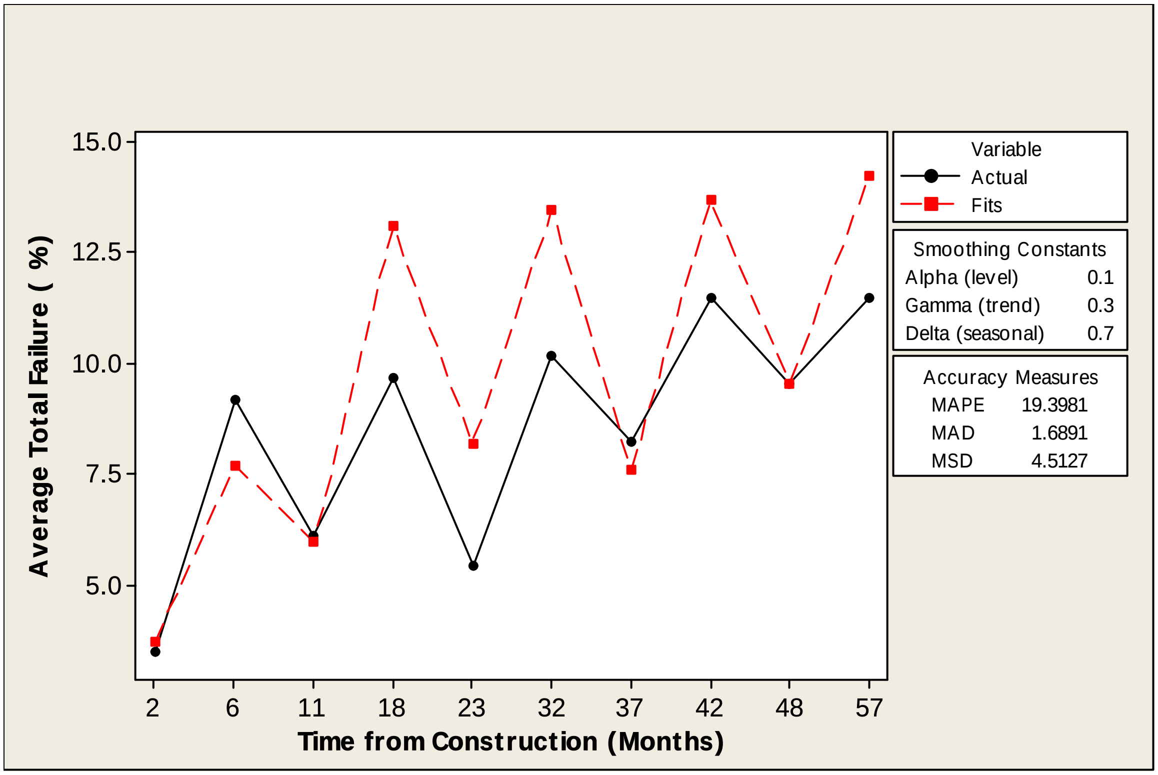

Figure 19: Winter's Seasonal Exponential Smoothing for Crafco 522, SQ-F

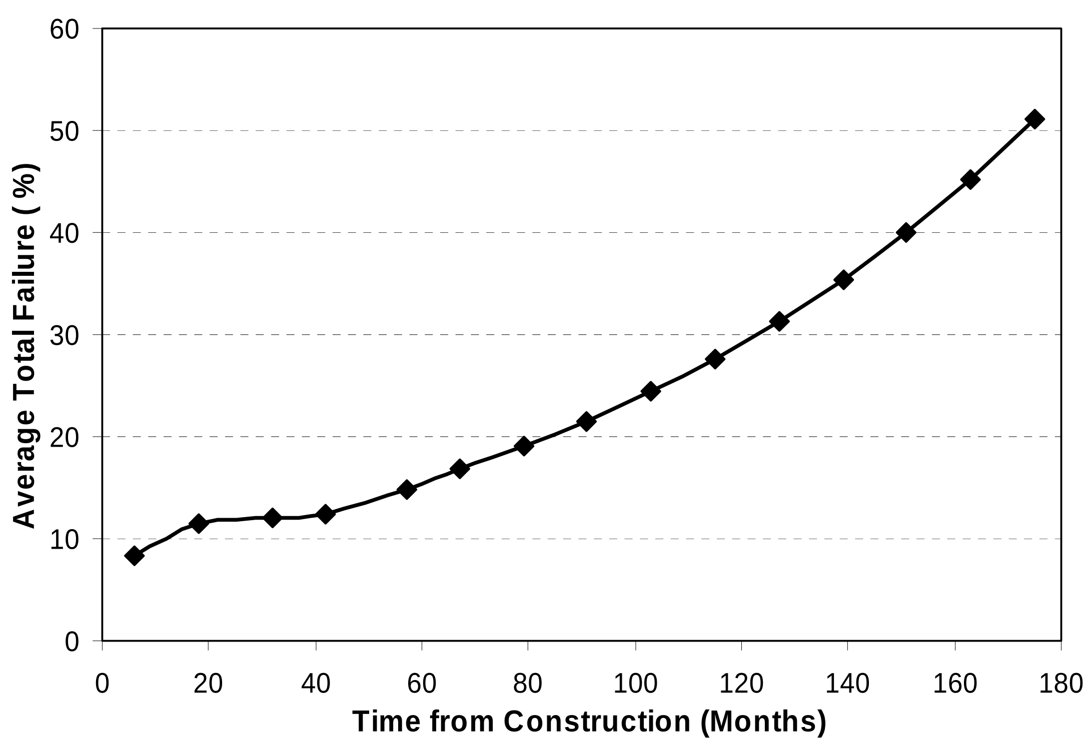

Figure 20: Eclectic Forecasting Results for Crafco 522, SQ-F

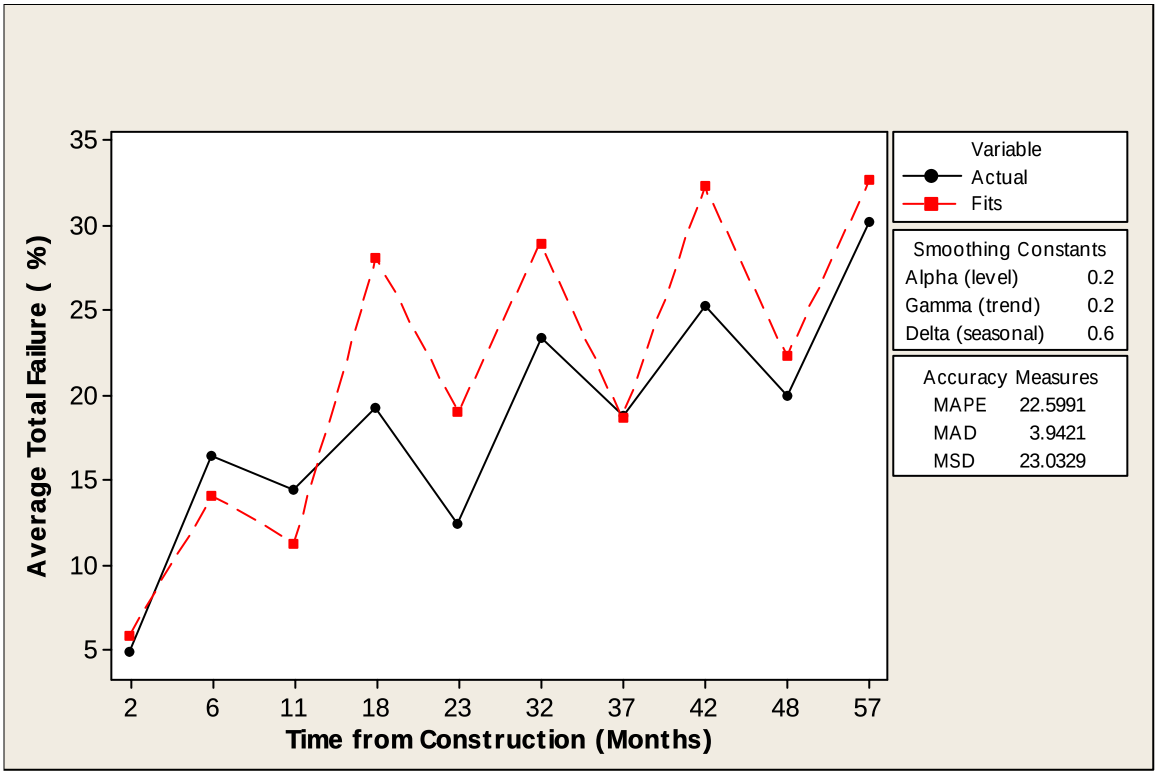

Figure 21: Winter's Seasonal Exponential Smoothing for Crafco 522, SQ-R

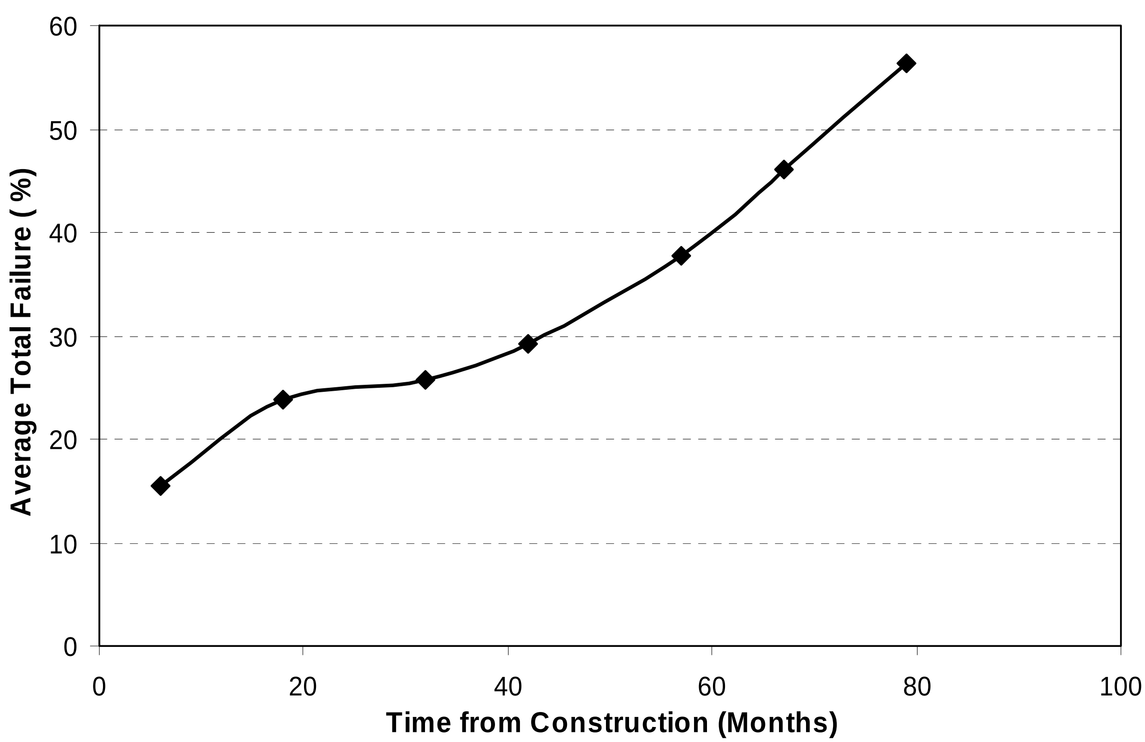

Figure 22: Eclectic Forecasting Results for Crafco 522, SQ-R

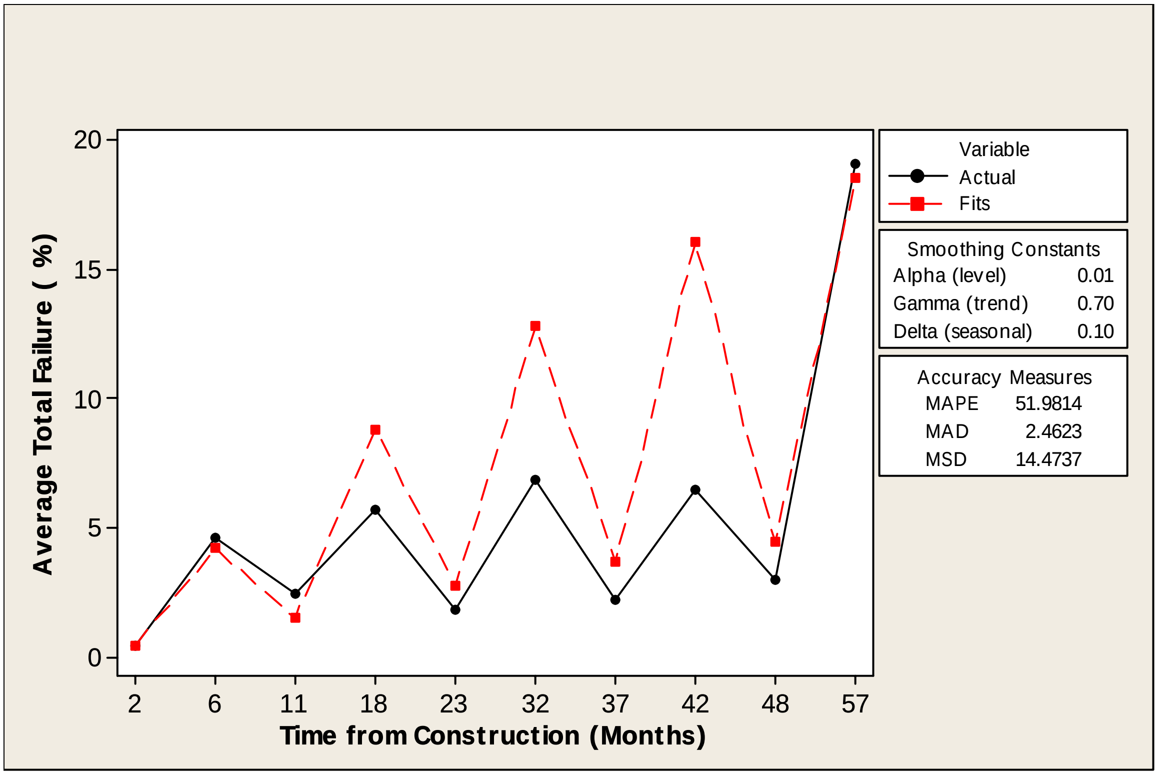

Figure 23: Winter's Seasonal Exponential Smoothing for Maxwell 71, SH-F

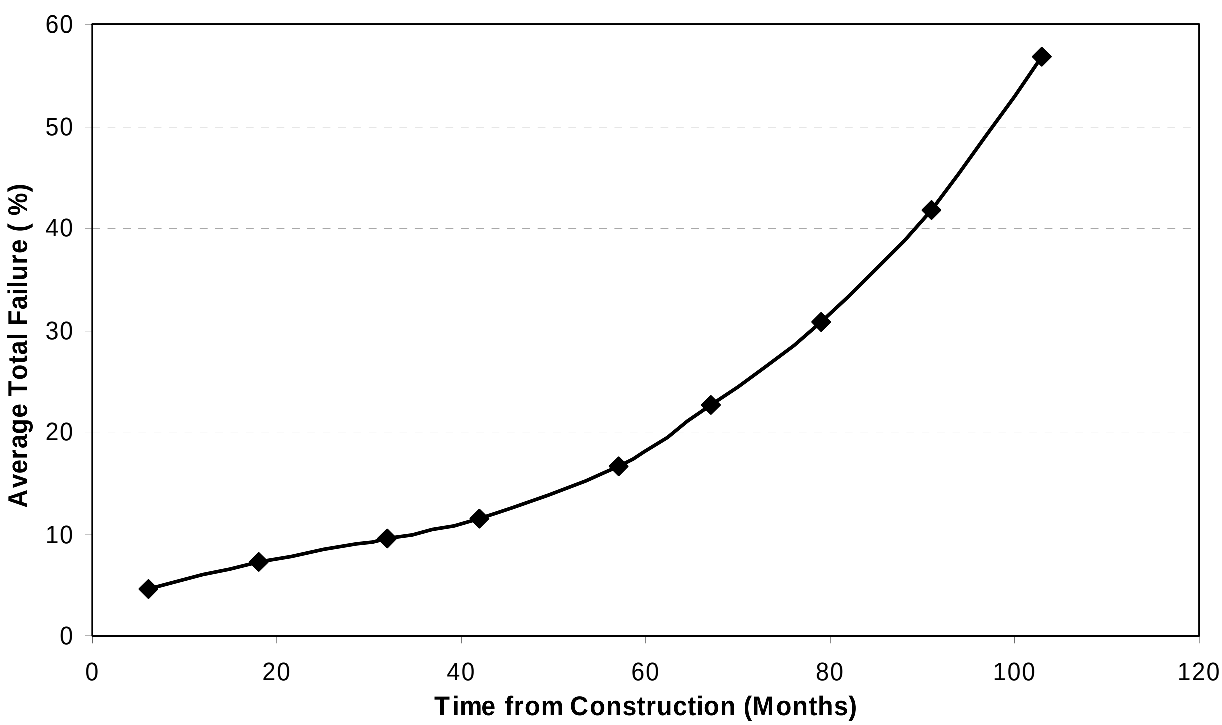

Figure 24: Eclectic Forecasting Results for Maxwell 71, SH-F

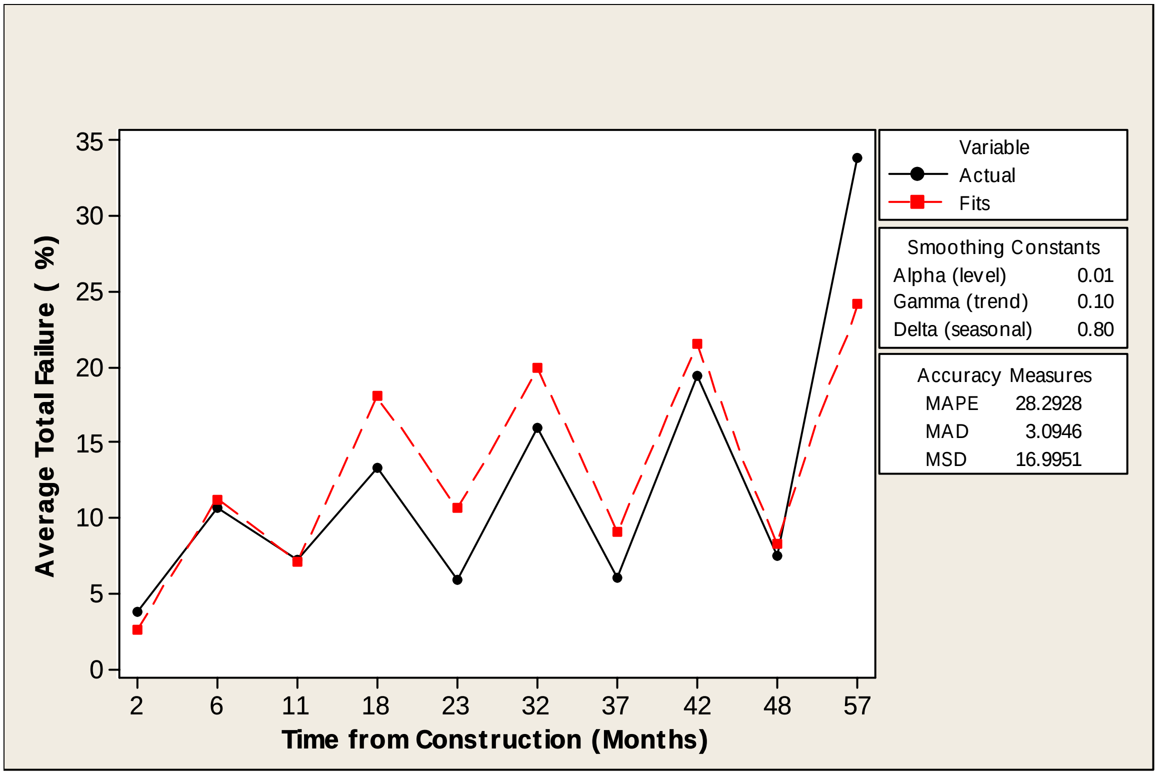

Figure 25: Winter's Seasonal Exponential Smoothing for Maxwell 71, SQ-F

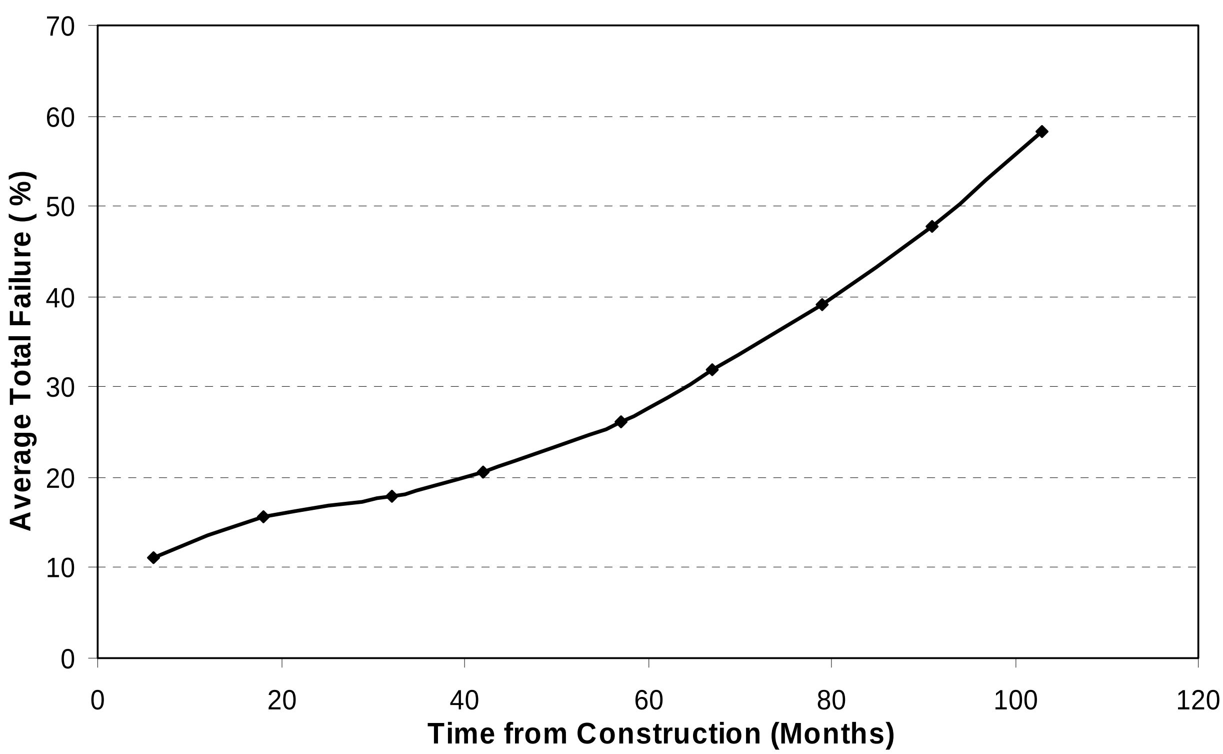

Figure 26: Eclectic Forecasting Results for Maxwell 71, SQ-F