Applied Research and Innovation Branch

YEARS TO FIRST REHABILITATION OF SUPERPAVE HOT MIX ASPHALT

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16. Abstract

The Colorado Department of Transportation (CDOT) spends more than 30 percent of its annual construction and maintenance budget on pavements, so pavements need to be properly designed using an analytical process with accurate design inputs. A pavement design needs to be performed during the early phase of project development to estimate and establish the project cost. The performance life of the initial pavement design and associated rehabilitations greatly impact the life cycle cost analysis (LCCA) used to determine the most cost-effective final pavement design. Currently, due to lack of actual data, an assumption of the expected life of an asphalt pavement is often being made. Thus, a precise initial pavement life span is essential for developing a reliable forecasting model and an accurate LCCA.

This study evaluated the performance of four roadway functional classes utilized by CDOT: interstates, principal arterials, minor arterials, and major collectors. Performance was evaluated with respect to smoothness, permanent deformation, fatigue cracking, transverse cracking, and longitudinal cracking.

Implementation

The purpose of this study was to quantify the initial design life of a roadway's pavement prior to rehabilitation and provide specific performance information through the analysis of pavement management data and historical experience. The analyzed data may be used to estimate the initial life of a pavement which can be incorporated into the LCCA within CDOT's M-E Pavement Design Guide. It will also provide guidance to CDOT and subcontractors in determining the cost-effectiveness of different pavement designs, construction and maintenance costs.

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EXECUTIVE SUMMARY

This study evaluated the performance of either initially constructed or reconstructed roadways utilizing a Superpave flexible pavement between years 2002 and 2009. The roadway segments were a minimum of one half mile in length and were divided into four roadway functional classes developed by CDOT: interstates, principal arterials, minor arterials, and major collectors. A statewide analysis utilizing all roadway data was also performed. Pavement performance was evaluated using CDOT's established terminal threshold values with respect to smoothness measured by the International Roughness Index (IRI), permanent deformation, fatigue cracking, transverse cracking, and longitudinal cracking.

Data analyzed in the study was obtained from CDOT's Pavement Management Systems Program. Results of this analysis indicate the distress triggering statewide pavement rehabilitations is IRI at 13 years followed by longitudinal cracking at 15 years. Permanent deformation resulted in rehabilitations at 17 years, fatigue cracking at 18 years and transverse cracking at 40 years.

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CHAPTER 1. INTRODUCTION TO THE PROJECT

1.1 BACKGROUND

The Colorado Department of Transportation (CDOT) spends more than 30 percent of its annual construction and maintenance budget on pavements, so pavements need to be properly designed using an analytical process with accurate design inputs. A pavement design needs to be performed during the early phase of project development to estimate and establish the project cost. The performance life of the initial pavement design and associated rehabilitations greatly impacts the life cycle cost analysis (LCCA) used to determine the most cost-effective final pavement design. Currently, due to lack of actual data, an assumption of the expected life of an asphalt pavement is often being made. Thus, a precise initial pavement life span is essential for developing a reliable forecasting model and an accurate LCCA.

The purpose of this study was to quantify the initial design life of a roadway's pavement prior to rehabilitation and provide specific performance information through the analysis of pavement management data and historical experience. The analyzed data may be used to estimate the initial life of a pavement which may be incorporated into the LCCA within CDOT's M-E Pavement Design Guide. It will also provide guidance to CDOT and subcontractors in determining the cost-effectiveness of different pavement designs, construction and maintenance costs.

1.2 DEFINITIONS

A list of terms and definitions relating to this study is located in Appendix C.

1.3 SCOPE AND GOALS OF RESEARCH

The goal of this research was to determine the performance of four roadway functional classifications utilized by CDOT. The objectives were:

- Determine the average amount of distress per year
- Determine the rate of deterioration per year
- Determine the coefficient of determination of the regression equations
- Determine which distress thresholds were reached first
- Provide instructions for updating the data in this study

The roadway functional classifications evaluated were interstates, principal arterials, minor arterials, and major collectors. The types of distresses and rate of change evaluated for each roadway classification were smoothness, permanent deformation, fatigue cracking, transverse cracking, and longitudinal cracking.

CHAPTER 2. LITERATURE REVIEW

Many studies have been conducted by state agencies concerning pavement design methods in conjunction with the LCCA. LCCA is an economic analysis used to evaluate the long-term cost of different pavement methods which includes the initial construction, yearly maintenance, and rehabilitation costs to determine the pavement design with the lowest long-term cost. The time between a pavement's initial construction

and first rehabilitation is an important variable for the LCCA. For example, a pavement requiring rehabilitation five years after construction verses one needing rehabilitation 25 years after construction may be less cost-effective in the long term due to a larger number of rehabilitation activities.

Even the best designed pavements will experience distresses during their life. Common distresses observed and measured in pavements after the initial construction or reconstruction include smoothness, permanent deformation, and cracking. Many state agencies, including CDOT, conduct roadway distress analysis and pavement performance on a yearly or bi-yearly basis. Terminal distress thresholds have been developed by CDOT to evaluate when maintenance or rehabilitation activities are necessary to extend the life of the pavement. Different state agencies use different initial pavement lives and terminal thresholds.

2.1 CDOT

The latest edition of CDOT's M-E Pavement Design Manual (PDM) has a chapter dedicated to the LCCA that was created to provide CDOT and consultant pavement designers with a uniform and detailed procedure for designing pavements on CDOT projects. CDOT requires an LCCA for all new construction or reconstruction projects with more than $2,000,000 initial pavement material cost so as to compare the overall project cost using different types of pavement designs. The various costs of the design alternatives are calculated over a 40-year analysis period and are the major consideration in selecting the preferred alternative. It is imperative that careful attention be given to the calculations and the data used in the calculations to ensure the most realistic and factual comparison between pavement types and rehabilitation strategies. Presently, the design life of initial construction for a hot mix asphalt pavement is 17 years with rehabilitation activities planned every 10 years thereafter.

The PDM has a table with recommended threshold values of performance criteria for new construction or reconstruction projects to be used for the M-E Design pavements. These threshold values represent the maximum recommended distress of a roadway prior to rehabilitation.

2.2 FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) published an interim technical bulletin in 1998 titled Life-Cycle Cost Analysis (LCCA) in Pavement Design to provide technical guidance and recommendations to engineers and pavement designers for conducting an appropriate LCCA. The publication discussed LCCA requirements, procedures, principles of good practice, user costs, and risk analysis.

CHAPTER 3. METHODOLOGY

Data analyzed in this study was obtained from CDOT's Pavement Management System Program's database which contains the results of pavement condition surveys collected annually since 1999. Each of the roadway sections analyzed were either newly constructed or reconstructed using a Superpave flexible pavement and a 20-year design life. The distresses observed and measured between 2002 and 2013 were analyzed to determine the pavement's performance from year to year and if a reconstruction had occurred prior to 2013. The original data was collected by CDOT's Pavement Management Program using an automated photo survey and laser profilometer equipment which records the pavement condition in

increments of 0.10 miles. As such, the asphalt pavement distresses are measured in 0.10 mile increments showing the direction of travel, thus each 0.10 mile increment represents a data point. A total of 58 roadway segments with lengths ranging from 1.0 to 18.5 miles were used in this study. The segments were either initially constructed or reconstructed sometime in the last four to 11 years. Tables showing the locations of the roadway segments, segment lengths, the year the project was completed, and asphalt type and binder are located in Appendix A.

The first step in analyzing the data was to search the pavement management's database for specific distress data collected from 2002 to 2013 and transferring it into an Excel database. The data was then organized into roadway sections, years, and directions of travel. Using this technique, if only one side of the roadway was reconstructed, the measured and observed distresses would not be confused with the opposite direction, eliminating directional errors affecting the results. The next step was to calculate a moving average for every 0.50 mile of the roadway segment surveyed. The 0.5 mile segmentation was chosen to represent the minimum length that CDOT would use to develop a project. This process was done with each measured distress type; smoothness, permanent deformation, and fatigue, transverse, and longitudinal cracking. The calculated averages were filtered, and the maximum moving average was determined and reported.

A summary sheet sorted by year showing the maximum moving average was provided for each highway segment per type of distress. Using the averages, a slope for a distress versus time curve was calculated for each roadway segment and plotted on a graph. A graph was created for each roadway functional classification and distress.

Two guidelines were established in order to decide whether to accept or reject the data. The first guideline is already in use by other CDOT projects and states, the regression equation should have a coefficient of determination (R-squared value) of greater than 0.50 unless the data seemed reasonable. An exception was made for longitudinal cracking because the minimum variation in the measured distress reported resulted in low coefficient of determination values, yet the data was reasonable. The second guideline was that no negative slopes would be used for the analysis. A negative slope means that the pavement was correcting itself, or getting better over time. This may be the result of gaps where the pavement condition survey data was not recorded or the pavement distress measurement may not be consistent from year to year creating fluctuations in the overall pavement rating.

After the data were sorted, the average level of distress was calculated for each year after reconstruction. The average was used to calculate the slope of deterioration from year to year for the length of the project. The slope of deterioration was then calculated and graphed for each roadway type and distress. A robust statistical analysis was not possible for all roadway classifications and distress combinations due to a lack of applicable roadway segments and data. Instead, a trend analysis was used to show how the cumulative distress of a particular roadway may affect performance of the pavement over time.

3.1 DATA ANALYSIS

An example of how the running average for every 0.5 mile was calculated is provided in Table 3.1. This particular example shows the measured smoothness starting at mile marker 279.5 and ending at mile marker 280.4. The first five IRI values are added together and then divided by the number five resulting in

88.4 inches per mile. Once the moving average has been calculated for length of the roadway, the maximum average value is determined. For the example shown in Table 1, 96.8 inches/mile is the maximum average IRI value, has been highlighted in red and reported at the bottom of the table.

Table 3.1 Calculating Average Roadway Condition

Beginning Mile Marker	Ending Mile Marker	IRI (inches/mile)	Average IRI (inches/mile)
279.5	279.6	96	
279.6	279.7	79	
279.7	279.8	76	
279.8	279.9	93	
279.9	280.0	98	88.4
280.0	280.1	79	85
280.1	280.2	95	88.2
280.2	280.3	85	90
280.3	280.4	127	96.8
280.4	280.5	83	93.8
		Maximum Average IRI	96.8

Tables located in Appendix B show the maximum running average of a particular distress and the associated years. In some cases, the collected data had gaps where the pavement condition survey data was either not recorded or the survey was not performed due to lack of funding or manpower. This is evident between the years of 2002 and 2006 when data was generally only collected every other year. A total of 58 roadway segments were evaluated in this study and are broken into four functional classifications for a total of 228.7, see Table 3.2.

Table 3.2 Number of Segments for Each Functional Classification

Functional Classification	Number of Segments	Total Number of Miles
Interstate	6	54.9
Principal Arterial	39	131.4
Minor Arterial	9	29.2
Major Collector	4	13.2
Total	58	228.7

3.1.1 Data Reduction

As mentioned earlier, the analysis used data collected from four to 11 years after a roadway's initial construction or reconstruction. The running average calculated for each roadway distress was regressed linearly indicating the distress associated with the number of years after initial reconstruction.

For example, the cumulative smoothness (IR) change for interstates regressed linearly resulted in the equation:

$$\Delta IRI = 4.08\ T$$

Where,

Δ IRI = change (usually an increase) in the smoothness in inches per mile

T = time after reconstruction, years

The same analysis was made for each distresses resulting in the following equations for interstates:

Smoothness: Δ IRI = 4.04 T

Permanent Deformation: Δ Rutting = 0.06 T

Fatigue Cracking: Δ Fatigue = 401.24 T

Transverse Cracking: Δ Transverse = 47.39 T

Longitudinal Cracking Δ Longitudinal = 101.20 T

Linear regression was performed on all roadway segments as shown in Table 3.3. The table also shows the coefficient of determination and the number of projects utilized in the regression.

Table 3.3 Linear Regression for Change in Performance

		Slope	R^2	Maximum n
Interstates	Smoothness	4.04	0.62	6
	Permanent Deformation	0.06	0.81	6
	Fatigue Cracking	401.24	0.82	6
	Transverse Cracking	47.39	0.82	6
	Longitudinal Cracking	101.20	0.52	6
Principal Arterials	Smoothness	7.39	0.59	39
	Permanent Deformation	0.02	0.74	39
	Fatigue Cracking	98.47	0.63	39
	Transverse Cracking	18.19	0.65	39
	Longitudinal Cracking	28.34	0.42	39
Minor Arterials	Smoothness	5.38	0.69	9
	Permanent Deformation	0.02	0.53	9
	Fatigue Cracking	85.56	0.61	9
	Transverse Cracking	57.29	0.63	9
	Longitudinal Cracking	20.80	0.33	9
Major Collectors	Smoothness	9.73	0.53	4
	Permanent Deformation	0.05	0.88	4
	Fatigue Cracking	86.37	0.82	4
	Transverse Cracking	39.84	0.73	4
	Longitudinal Cracking	8.07	0.26	4

Statewide	Smoothness	6.60	0.57	58
	Permanent Deformation	0.02	0.61	58
	Fatigue Cracking	136.33	0.66	58
	Transverse Cracking	27.90	0.67	58
	Longitudinal Cracking	35.86	0.40	58

3.2 TERMINAL THRESHOLD

The terminal threshold is the point at which the level of measured distress in the roadway exceeds what is considered by CDOT forces as an acceptable condition, resulting in a zero remaining service life of the pavement. The threshold values were obtained from the CDOT 2015 M-E Pavement Design Manual, are shown in Table 3.4 and are also represented as dashed, red, horizontal lines on the performance curves located in Appendix B. The terminal thresholds provide a baseline indicating when or if the pavements have exceeded an acceptable roadway condition and should being rehabilitated.

Table 3.4 Zero-Remaining Service Life

Roadway Type	Distress	Terminal Threshold
Interstates	Smoothness (in./mi.)	160
	Permanent Deformation (in.)	0.40
	Fatigue Cracking (in./mi.)	2,000
	Transverse Cracking (in./mi.)	1,500
	Longitudinal Cracking (in./mi.)	500
Principal Arterials	Smoothness (in./mi.)	200
	Permanent Deformation (in.)	0.5
	Fatigue Cracking (in./mi.)	2,500
	Transverse Cracking (in./mi.)	1,500
	Longitudinal Cracking (in./mi.)	500
Minor Arterials	Smoothness (in./mi.)	200
	Permanent Deformation (in.)	0.65
	Fatigue Cracking (in./mi.)	3,000
	Transverse Cracking (in./mi.)	1,500
	Longitudinal Cracking (in./mi.)	500
Major Collectors	Smoothness (in./mi.)	200
	Permanent Deformation (in.)	0.65
	Fatigue Cracking (in./mi.)	3,000
	Transverse Cracking (in./mi.)	1,500
	Longitudinal Cracking (in./mi.)	500

As mentioned earlier, the running average was calculated for each roadway classification and distress and plotted on a graph. Additionally, one standard deviation of the average was also plotted. A terminal threshold based on values in the PDMl was assigned to each distress based on the roadway's classification.

For Example, the smoothness threshold for an interstate is 160, while the minor arterial's smoothness threshold is 200. The terminal threshold(s) was also plotted on the graphs to determine how many years after the initial construction/reconstruction until the terminal threshold would be reached.

CHAPTER 4. RESULTS OF STUDY

All of the pavement performance data for smoothness, rutting, fatigue, transverse, and longitudinal cracking with respect to each roadway type is presented in Appendix B. The rate of change of distress over time is also represented in Appendix B's tables and figures and was been calculated as a linear function. The average number of highway segments (n) which contributed to these statistics is also shown to provide an indication of the analysis robustness. Year 0 (zero) on the graphs represents the time roadway segments initial construction or reconstruction.

A summary of the statewide results for the first year to rehabilitation is shown in Table 4.1 and the pavement performance data for smoothness, rutting, fatigue, transverse, and longitudinal cracking with respect to each roadway type is shown in Appendix B. The average number of highway segments (n) which contributed to these statistics is also shown to provide an indication of analysis's robustness. Year 0 (zero) on the performance curve graphs is the time of initial reconstruction, Appendix B.

Table 4.1 Summary of Statewide Pavement Performance Data

Distress	Terminal Threshold	Slope	R^2	Years Until Threshold was Exceeded		
				Average	Average – 1 Std. Dev.	Average + 1 Std. Dev.
Smoothness (IRI) [1]	160 (in./mi.)	6.60	0.57	13	7	19
	200 (in./mi.)	6.60	0.57	19	13	25
Permanent Deformation [2]	0.4 inches	0.02	0.61	17	14	20
	0.5 inches	0.02	0.61	22	19	25
	0.65 inches	0.02	0.61	29	26	32
Fatigue Cracking [3]	2,000 (ft./mi.)	136.33	0.66	18	5	25
	2,500 (ft./mi.)	136.33	0.66	22	9	29
	3,000 (ft./mi.)	136.33	0.66	25	13	33
Transverse Cracking	1,500 (ft./mi.)	27.90	0.67	40[4]	40[4]	40[4]
Longitudinal Cracking	500 (ft./mi.)	35.86	0.40	15	9	40[4]

(1) A terminal threshold of 160 inches per mile was used for interstates and an IRI of 200 inches was used for all other roadways.
(2) A terminal threshold 0.4 inches was used for interstates, 0.5 inches for principal arterials, and 0.65 for all other roadways.
(3) A terminal threshold of 2,000 feet per mile was used for interstates, 2,500 feet per mile for principal arterials, and 3,000 feet per mile for all other roadways.
(4) Years until terminal threshold was exceeded is greater than 40 years.

4.1 PRINCIPAL ARTERIALS

The initial construction and/or reconstruction sections analyzed consisted of 39 sections and four to 11 years of data. The analysis shows that on average, the smoothness threshold was met at year 19, and the

permanent deformation and fatigue cracking threshold was met at year 23. However, the transverse cracking threshold was not met within the 40 years used by CDOT's LCCA model, thus was truncated to year 40. The longitudinal cracking threshold was met at year 15. Data for principal arterials is summarized in Table 4.2.

Table 4.2 Summary of Principal Arterial Pavement Performance Data

Distress	Terminal Threshold	Slope	R^2	Years Until Threshold was Exceeded		
				Average	Average – 1 Std. Dev.	Average + 1 Std. Dev.
Smoothness (IRI)	200 (in./mi.)	7.39	0.59	19	14	23
Permanent Deformation	0.5 inches	0.02	0.74	23	20	26
Fatigue Cracking	2,500 (ft./mi.)	98.47	0.63	23	9	35
Transverse Cracking	1,500 (ft./mi.)	18.19	0.65	40(1)	40(1)	40(1)
Longitudinal Cracking	500 (ft./mi.)	28.34	0.42	16	9	40(1)

(1) Years until terminal threshold was exceeded is greater than 40 years.

4.2 MINOR ARTERIALS

The initial construction and/or reconstruction sections analyzed consisted of nine sections and four to nine years of data. The analysis shows that on average, the smoothness threshold was met at year two, the permanent deformation threshold was met at year 30 and the fatigue cracking threshold was met at year 31. The transverse cracking threshold was met at year 32 and the longitudinal cracking threshold was met at year 10. The data for minor arterials is summarized in Table 4.3.

Table 4.3 Summary of Minor Arterial Pavement Performance Data

Distress	Terminal Threshold	Slope	R^2	Years Until Threshold was Exceeded		
				Average	Average – 1 Std. Dev.	Average + 1 Std. Dev.
Smoothness (IRI)	200 (in./mi.)	5.38	0.69	25	16	31
Permanent Deformation	0.65 inches	0.02	0.52	30	27	32
Fatigue Cracking	3,000 (ft./mi.)	85.56	0.61	31	16	35
Transverse Cracking	1,500 (ft./mi.)	57.29	0.63	32	27	33
Longitudinal Cracking	500 (ft./mi.)	20.80	0.33	10	9	24

(1) Years until terminal threshold was exceeded is greater than 40 years.

4.3 INTERSTATES AND MAJOR COLLECTORS

There were limited roadway sections available for analysis for functional classification of interstates (six projects) and major collectors (four projects). This resulted in insufficient data to determine the number of years until first rehabilitation for these two classifications. The data collected from these roadway sections was added to the statewide data for statewide analysis.

CHAPTER 5. ANALYSIS

An analysis was performed to determine the average time it takes for each distress to reach a zero-year service life, indicating the first year for rehabilitation. Pavement performance is measured by the overall deterioration over time and is represented as a linear slope. The slope is the main contributing factor in determining the number of years until the zero-life or terminal threshold of a distress is met. The data in this study is intended for possible incorporation into CDOT's LCCA process.

CHAPTER 6. RECOMMENDATIONS

The analysis was performed on limited data based on CDOT's use of Superpave HMA in 2002. Currently, only 58 roadway segments meet the Superpave criteria and some roadway types only had four or five segments used for analysis. Our analysis indicates the majority of the projects have not required reconstruction, thus are considered ongoing and should be used for additional performance data collection. It is recommended that an analysis occur every few years until the sample size becomes large enough to adequately represent all performance criteria. In addition to the existing 58 roadway segments, data from new construction or reconstruction projects should be added to the database. A program or process that can automatically select data from the Access database should be developed so the entire roadway network can be easily analyzed.

Until additional data is collected and analyzed, implementation for changes in 'years to first rehabilitation' for the LCCA should be limited and engineering judgment and regional/historical experience should be taken into consideration. We recommend that in conjunction with the data obtained in this study, Region Material Engineers use the analysis of individual roadways along with their expertise.

This study did not address the type of gradation and binder used for each segment's reconstruction. As the data base increases, more detailed analysis of the various products may be performed.

CHAPTER 7. CONCLUSIONS

The following conclusions were reached from the data analysis:

1. The pavement management database is a useful tool for analyzing the performance of various distresses to roadways after initial construction or reconstruction.

2. There was not enough data in the database to evaluate each roadway functional classification on an individual basis. Interstates and major collectors were excluded from the individual classifications, but were included in the statewide performance results.

3. The triggering mechanism for reconstruction is smoothness at year 13 followed by longitudinal cracking at year 15 and permanent deformation at year 17.

4. Transverse cracking showed the least amount of distress on statewide projects resulting in 40 years until the terminal threshold would be met.

CHAPTER 8. FUTURE RESEARCH

A more complete analysis of CDOT's pavement management database is needed to ensure a sample size large enough for all criteria to be represented adequately. Some roadway types did not have adequate amounts of data or the data that was included did not meet the predetermined criterion. The spreadsheets need to be continually updated as CDOT collects additional pavement distress data. A program or process that can automatically select data from the Access database is needed so the entire roadway network can be analyzed annually.

APPENDIX A

ROADWAY SECTIONS USED IN THIS STUDY

Table A.1. Interstate Roadway Sections Used in the Study

Roadway	Year of Last Construction	Type of Construction			Beginning Mile Marker	Ending Mile Marker	Length	Direction
		Depth	Grading of the Top Lift	PG Binder				
25A	2008	10.0	SX (100)	64-22	79.6	85.5	5.9	1
25A	2008	10.0	SX (100)	64-22	79.6	85.5	5.9	2
70A	2005	11.0			5.0	11.6	6.6	1
70A	2005	11.0			5.0	11.6	6.6	2
70A	2004	6.75			22.0	37.0	15.0	1
70A	2004	6.75			22.0	37.0	15.0	2

Table A.2. Minor Arterial Roadway Sections Used in the Study

Roadway	Year of Last Construction	Type of Construction			Beginning Mile Marker	Ending Mile Marker	Length	Direction
		Depth	Grading of the Top Lift	PG Binder				
7D	2005	13.0	SX (100)	76-28	68.1	69.4	1.3	1
9D	2004	6.0	S (75)	58-34	109.0	113.5	5.5	1
52A	2006	6.0	S	64-28	36.9	42.0	5.1	1
115A	2005	7.0	S (100)	64-28	24.2	26.0	1.8	1
115A	2005	7.0	S (100)	64-28	24.3	225.5	1.2	2
115A	2004	6.0	S (100)	64-28	35.8	37.1	1.3	2
115A	2004	6.0	S (100)	64-28	36.1	38.2	2.1	1
133A	2008	7.0			0.0	5.0	5.0	1
133A	2008	7.0			6.0	11.0	6.0	1

Table A.3. Major Collector Roadway Sections Used in the Study

Roadway	Year of Last Construction	Type of Construction			Beginning Mile Marker	Ending Mile Marker	Length	Direction
		Depth	Grading of the Top Lift	PG Binder				
12A	2003	6.0	S (75)	58-28	51.7	55.6	3.9	1
79A	2008	7.0	SX (100)	64-28	0.0	1.3	1.3	1
92A	2003	6.0			0.0	4.0	4.0	1
92A	2003	6.0			0.0	4.0	4.0	2

Table A.4. Principle Arterial Roadway Sections Used in the Study

Roadway	Year of Last Construction	Type of Construction			Beginning Mile Marker	Ending Mile Marker	Length	Direction
		Depth	Grading of the Top Lift	PG Binder				
14C	2005	7.5	S	64-28	176.0	194.5	18.5	1
21B	2008	7.5	SX (100)	76-28	148.0	149.4	1.4	1
21B	2008	7.5	SX (100)	76-28	148.0	149.4	1.4	2
21B	2002	8.0	SX (100)	76-28	150.0	151.0	1.0	1
21B	2002	8.0	SX (100)	76-28	150.0	151.0	1.0	2
21B	2004	8.0	SMA (100)	76-28	151.0	153.6	2.6	2
24A	2005	6.0	S (100)	58-28	277.8	279.5	1.7	1
24A	2005	6.0	S (100)	58-28	278.0	279.5	1.5	2
24A	2002	6.0	S (100)	58-28	279.5	282.5	2.9	1
24G	2004	9.5	S (100)	64-28	312.2	313.9	1.7	1
24G	2004	9.5	S (100)	64-28	312.2	313.9	1.6	2
24G	2005	8.0	SX (100)	64-28	313.9	318.9	5.1	1
34A	2007	12.0	SX	64-22	88.7	90.8	2.1	1
34A	2007	12.0	SX	64-22	88.7	90.8	2.1	2
40A	2002	6.0	SX (68)	58-40	244.3	247.1	2.8	1
40A	2007	6.0	SX (75)	58-34	247.1	249.1	2.0	1
40A	2004	6.0			229.9	232.4	2.5	1
40A	2004	6.0			229.9	232.4	2.5	2
50A	2002	6.75			46.3	53.3	7.0	1
50A	2003	7.0			53.3	59.0	5.7	1
50A	2004	7.0			59.0	65.4	6.4	1
50A	2004	6.75			65.4	70.5	5.1	1
50A	2004	6.75			65.4	70.5	5.1	2
50A	2006	6.5			103.0	109.4	6.4	1
50B	2008	7.0	SX (100)	64-22	338.0	341.0	3.0	1
83A	2005	10.0	SMA (100)	76-28	20.4	21.8	1.4	1
83A	2005	10.0	SMA (100)	76-28	20.4	21.7	1.3	2
85A	2004	6.0	S (75)	64-28	132.5	134.0	1.5	1
85A	2004	6.0	S (75)	64-28	132.5	134.0	1.5	2
85A	2006	6.0	SX (100)	64-28	134.0	135.1	1.1	1
85A	2006	6.0	SX (100)	64-28	134.0	135.1	1.1	2
85B	2004	10.0	SX (100)	76-28	186.2	187.4	1.2	1
160A	2009	6.0	SX (75)	64-22	21.4	23.1	1.7	1
160A	2004	7.0	SX (75)	58-28	55.2	56.7	1.5	1
160A	2004	6.0	SX (75)	58-34	158.6	163.9	5.4	1
160A	2002	6.0	SX (75)	58-28	163.9	168.8	4.9	1
285B	2003	6.5	SX (75)	58-34	100.4	111.6	11.7	1
285D	2008	7.5	SX (100)	64-28	233.0	235.0	2.0	1
287C	2000	6.0	S	76-28	316.0	318.3	2.3	1
550A	2009	6.0	SX (75)	64-22	0.8	3.0	2.2	1

APPENDIX B

CALCULATIONS

Linear Regression Indicating Change in Performance and Average Life

		Terminal Threshold	Slope	R^2	Years Until Threshold was Exceeded			Average Yrs. Until Rehab. [1]	No. of Years Ave. is Greater than 1 Std. Dev.	Maximum n [2]
					Average	Average - 1 Std. Dev.	Average + 1 Std. Dev.			
Interstates	Smoothness (IRI)	160 (in./mi.)	4.0367	0.6224	N/A	N/A	N/A	N/A	-	6
	Permanent Deformation	0.4 inches	0.0604	0.8073	N/A	N/A	N/A	N/A	-	6
	Fatigue Cracking	2,000 (ft./mi.)	401.2440	0.8231	N/A	N/A	N/A	N/A	-	6
	Transverse Cracking	1,500 (ft./mi.)	47.3875	0.8168	N/A	N/A	N/A	N/A	-	6
	Longitudinal Cracking	500 (ft./mi.)	101.2039	0.5230	N/A	N/A	N/A	N/A	-	6
Principal Arterials	Smoothness (IRI)	200 (in./mi.)	7.3923	0.5904	18	13	21	12.7	0.3	39
	Permanent Deformation	0.5 inches	0.0211	0.7384	23	20	26	20.1	-	39
	Fatigue Cracking	2,500 (ft./mi.)	98.4686	0.6308	23	9	35	14.2	-	39
	Transverse Cracking	1,500 (ft./mi.)	18.1947	0.6501	40 [3]	40 [3]	40 [3]	5.3	34.7	39
	Longitudinal Cracking	500 (ft./mi.)	28.3390	0.4165	16	9	40 [3]	12.2	-	39
Minor Arterials	Smoothness (IRI)	200 (in./mi.)	5.3803	0.6932	25	16	31	18.5	-	9
	Permanent Deformation	0.65 inches	0.0212	0.5263	30	27	32	21.5	5.5	9
	Fatigue Cracking	3,000 (ft./mi.)	85.5634	0.6132	31	16	35	14.2	1.8	9
	Transverse Cracking	1,500 (ft./mi.)	57.2857	0.6263	32	27	33	6.0	21.0	9
	Longitudinal Cracking	500 (ft./mi.)	20.8046	0.3262	10	9	24	16.5	-	9
Major Collectors	Smoothness (IRI)	200 (in./mi.) [4]	9.7357	0.5272	N/A	N/A	N/A	N/A	-	4
	Permanent Deformation	0.65 inches	0.0452	0.8817	N/A	N/A	N/A	N/A	-	4
	Fatigue Cracking	3,000 (ft./mi.)	86.3700	0.8169	N/A	N/A	N/A	N/A	-	4
	Transverse Cracking	1,500 (ft./mi.)	39.8443	0.7314	N/A	N/A	N/A	N/A	-	4
	Longitudinal Cracking	500 (ft./mi.)	8.0709	0.2552	N/A	N/A	N/A	N/A	-	4
Statewide	Smoothness (IRI)	160 (in./mi.) [5]	6.6012	0.5666	13	7	19	18.5	-	58
	Smoothness (IRI)	200 (in./mi.) [5]	6.6012	0.5666	19	13	25	18.5	-	58
	Permanent Deformation	0.4 inches [6]	0.0204	0.6114	17	14	20	21.5	1.5	58
	Permanent Deformation	0.5 inches [6]	0.0204	0.6114	22	19	25	21.5	-	58
	Permanent Deformation	0.65 inches [6]	0.0204	0.6114	29	26	32	21.5	4.5	58
	Fatigue Cracking	2,000 (ft./mi.) [7]	136.3309	0.6630	18	5	25	12.4	-	58
	Fatigue Cracking	2,500 (ft./mi.) [7]	136.3309	0.6630	22	9	29	12.4	-	58
	Fatigue Cracking	3,000 (ft./mi.) [7]	136.3309	0.6630	25	13	33	12.4	0.6	58
	Transverse Cracking	1,500 (ft./mi.)	27.9048	0.6668	40 [3]	40 [3]	40 [3]	14.3	25.7	58
	Longitudinal Cracking	500 (ft./mi.)	35.8567	0.3953	15	9	40 [3]	13.8	-	58

(1) Average years until rehabilitation is a check used to verify the calculated years are within one standard deviation of the average.

(2) Maximum number of segments used in analysis.

(3) Years until the terminal threshold was exceeded is greater than 40 years.

(4) The CDOT Pavement Design Manual does not have a smoothness terminal threshold value for major collectors; for this study 200 inches per mile was used.

(5) A terminal threshold of 160 inches per mile was used for interstates and an IRI of 200 inches was used for all other roadways.

(6) A terminal threshold 0.4 inches was used for interstates, 0.5 inches for principal arterials, and 0.65 for all other roadways.

(7) A terminal threshold of 2,000 feet per mile was used for interstates, 2,500 feet per mile for principal arterials, and 3,000 feet per mile for all other roadways.

(8) Limited data, unable to make analysis

N/A - not applicable due to limited data set

Terminal IRI and the Increase in IRI
Interstates (2002-2013)

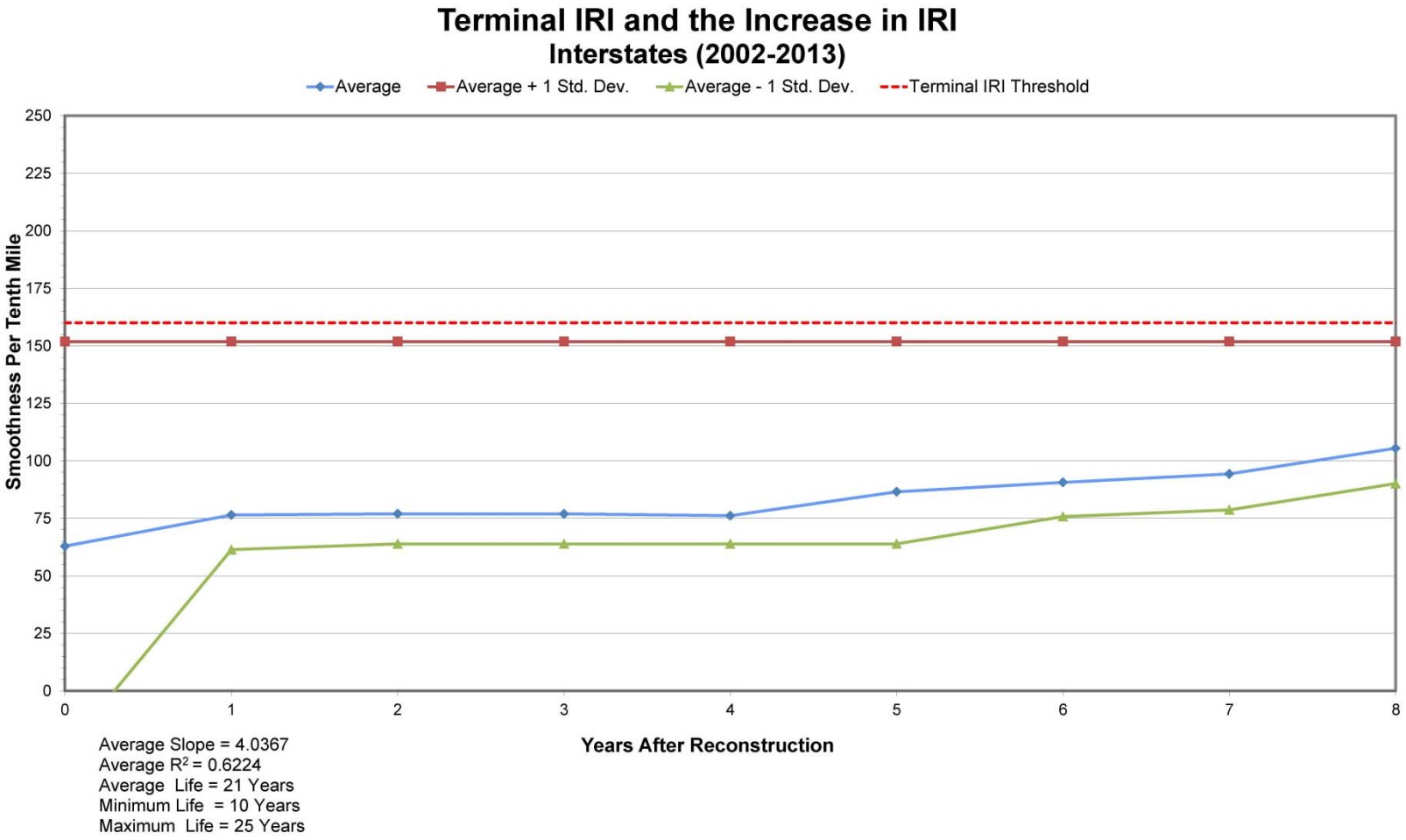
Highway	Starting MM	Ending MP	Length (miles)	Direction
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs Until Rehab
125.8	71.8	74.4	70.4	61.4	60.2										NA
	66.6	68.6	65.4	69.0	69.6								0.6400	0.3274	NA
	64.6	67.2	68.4	77.2	101.8	94.8	97.8	104.2					6.3571	0.8580	25.2
	65.2	65.6	65.2	68.6	68.4	70.0	72.0	84.2					2.1333	0.6938	NA
0.0	90.8	88.8	93.4	83.4	114.8	92.4	99.0	116.6					8.6600	0.4756	13.0
	100.0	97.4	98.8	97.6	104.8	105.4	108.4	117.0					2.3929	0.7570	26.0
Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation			21.4

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	13		
Average	62.9000	76.5000	77.0000	76.9333	76.2000	86.6000	90.6500	94.3000	105.5000					**4.0367**	**0.6224**
Std. Dev.	88.9540	15.1403	13.1051	15.0698	12.9572	23.1289	14.8803	15.6038	15.3931						
Ave + 1 Std. Dev.	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540						
Ave - 1 Std. Dev.	-26.0540	61.3597	63.8949	63.8949	63.8949	63.8949	75.7697	78.6962	90.1069						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	6	6	6	6	6	4	4	4	0	0	0	0		
Terminal IRI	160	160	160	160	160	160	160	160	160	160	160	160	160		


Terminal IRI and the Increase in IRI
Interstates (2002-2013)
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal IRI Threshold
Smoothness Per Tenth Mile
250
225
200
175
150
125
100
75
50
25
0
0
1
2
3
4
5
6
7
8
Years After Reconstruction
Average Slope = 4.0367
Average R² = 0.6224
Average Life = 21 Years
Minimum Life = 10 Years
Maximum Life = 25 Years

Terminal IRI and the Increase in IRI

Principal Arterials (2002-2013)

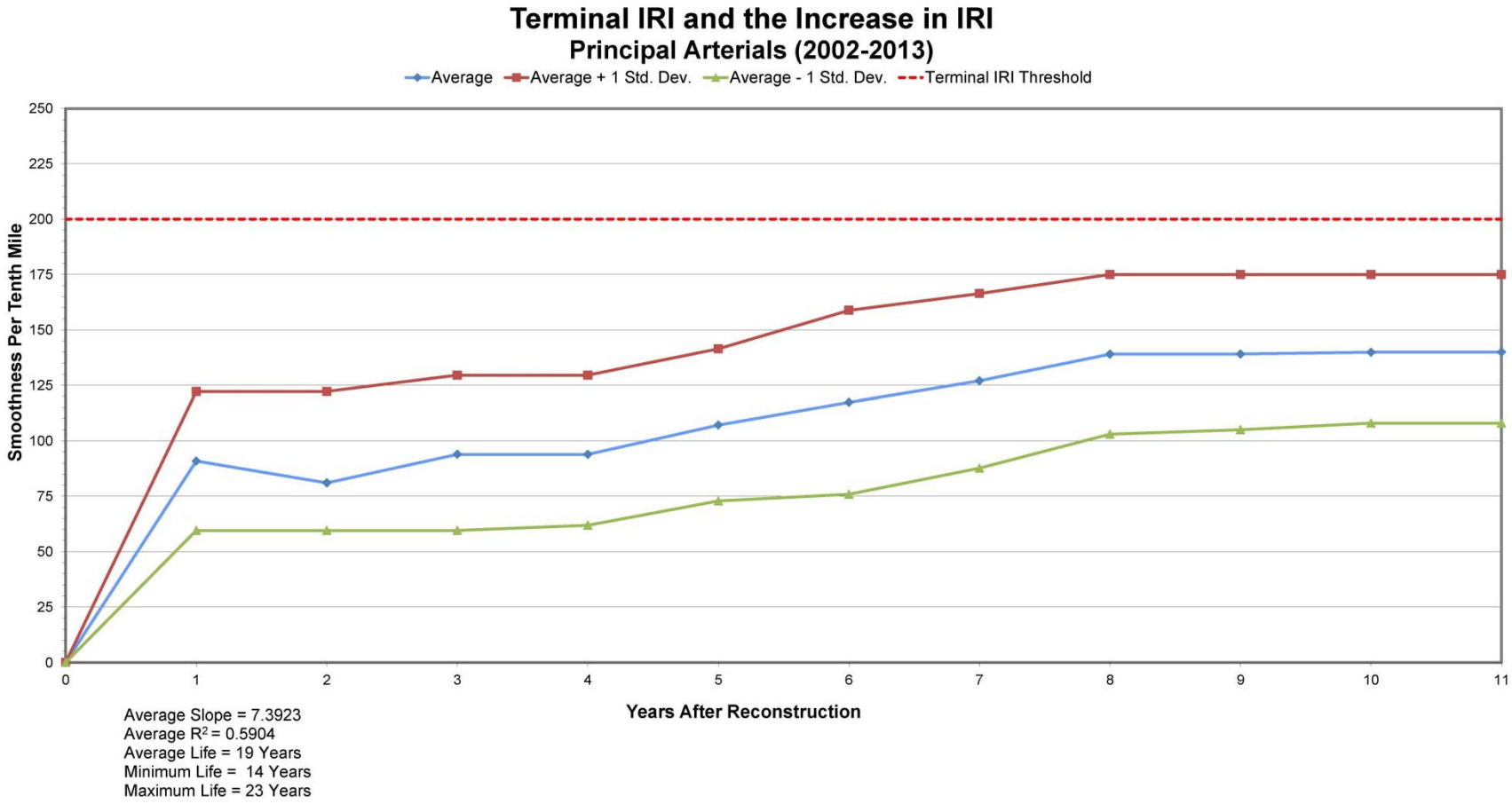
Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
	123.2		123.8		133.0		140.4		135.2	138.0	134.4		1.4253	0.6394	NA
		137.0		124.6	123.0	110.8									
	94.4		101.4	91.2	122.2								5.0857	0.3886	5.0
	82.2	82.2	81.0	78.6	84.4								0.0800	0.0036	NA
	78.4	75.8	78.2	102.0	103.8								7.7000	0.7582	26.0
		0.0	0.0	65.8	66.2								26.4400	0.8024	7.6
						101.2	122.6	136.6	122.6	125.0	130.4		3.9771	0.3849	NA
0.0							122.6	123.6	166.2		198.2		17.8400	0.9837	11.2
0.0						144.4	126.8	129.0	159.4	189.2			17.6937	0.9298	10.0
	124.2	126.2	120.2	126.8	139.2	127.0	130.2						1.3786	0.2527	7.0
	121.4	129.2	130.2		157.6	152.0	159.2	180.0					7.6247	0.9222	26.2
	99.0	109.0	89.2	91.4	92.2	95.8	100.0	102.2	96.2	97.4	103.6		0.2455	0.0196	NA
	73.4	73.8		75.6	78.8	74.6	74.0	155.0	180.2				11.1973	0.5275	17.9
		95.6	89.4										-6.2000	1.0000	-32.3
	58.6	112.2		104.0	109.0	115.8	129.6	139.6					8.5841	0.7304	23.3
		52.0	51.6	58.6	58.0								2.5000	0.7351	NA
	93.2	99.2	88.8	102.0	104.0	111.8	106.8	175.4					8.1476	0.5322	24.5
	81.8	84.8	86.8	97.6	95.6	97.4	96.8	95.6					2.2190	0.7074	NA
	81.0	60.8	71.2	74.6	93.2	76.2	115.6	142.4					8.7786	0.6318	8.0
	62.4	79.4	67.8	68.0	71.4	68.8	183.6	185.0					16.4952	0.5748	8.0
	51.8	53.2	59.2	58.2	57.4		69.6						2.6429	0.8250	NA
	72.6	61.2	68.4	62.0	61.6	66.4	205.2						14.3357	0.3412	14.0
	202.4		204.0	195.4	180.4	245.0	225.0	225.8					4.8926	0.2904	8.0
	146.4		147.8		167.2	157.2	163.0	173.6	172.6				3.5365	0.8092	NA
			69.4		138.4		179.8		190.0	165.6			14.3610	0.7232	10.0
		68.2			74.8	158.2		160.8	173.6				16.4933	0.7795	9.0
	66.8		106.2		126.8	130.0	133.6	151.6	127.8				8.4251	0.7680	23.7
	71.2		105.2		93.4	138.6	128.2	142.0	123.6				7.5826	0.6834	26.4
			87.8	70.4			93.2	110.4	86.6				2.9821	0.2884	NA
	93.8		139.0	145.8	143.4								13.0857	0.8234	5.0
		65.8		69.0	67.8	65.2	75.0	66.4					0.4971	0.0887	NA
	72.4	79.8	116.4	126.6	156.8	163.8							19.9486	0.9661	10.0
	79.4	81.8	105.8	111.6	138.8								14.8600	0.9322	13.5
	74.6	69.4	75.4	78.0									1.6200	0.3365	NA
	88.8		85.4		83.8	89.8	89.2	129.0					3.8000	0.3340	8.0
	104.4		100.2		108.4	105.6	103.8	104.8	103.2				0.1054	0.0143	NA
	88.6		98.6		91.8		113.0	128.0		152.8	133.4		5.9097	0.8083	33.8
		84.4		98.0		104.0	116.8	102.4	110.6	111.4			3.1359	0.6851	NA
	69.0	65.2	70.4	72.2									1.4800	0.4136	NA
													Average Years Until Rehabilitation		12.7

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	90.9407	81.0917	93.9600	93.9200	107.1742	117.3739	127.0615	139.0545	139.1286	139.9143	140.0000		**7.3923**	**0.5904**
Std. Dev.	0.0000	31.3205	29.2433	35.6238	31.9613	34.2626	41.4586	39.3548	35.9655	34.0725	31.8892	34.9259			
Ave + 1 Std. Dev.	0.0000	122.2613	122.2613	129.5838	129.5838	141.4368	158.8326	166.4164	175.0200	175.0200	175.0200	175.0200			
Ave - 1 Std. Dev.	0.0000	59.6202	59.6202	59.6202	61.9587	72.9116	75.9153	87.7067	103.0890	105.0561	108.0251	108.0251			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	27	24	30	25	31	23	26	22	14	7	5	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		


Terminal IRI and the Increase in IRI
Principal Arterials (2002-2013)
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal IRI Threshold
Smoothness Per Tenth Mile
250
225
200
175
150
125
100
75
50
25
0
0
1
2
3
4
5
6
7
8
9
10
11
Years After Reconstruction
Average Slope = 7.3923
Average R² = 0.5904
Average Life = 19 Years
Minimum Life = 14 Years
Maximum Life = 23 Years

Terminal IRI and the Increase in IRI

Minor Arterials (2002-2013)

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Years Until Rehab
	81.6		82.6		86.2	88.4	86.2						1.0431	0.7948	7.0
0.0	54.0	78.4	85.2	83.4	81.4	78.6	79.8	79.8					6.5533	0.4278	30.5
	56.4	58.0	61.8	67.2	67.0	66.2	75.0	69.0					2.2167	0.7955	NA
		75.8	78.4	79.8	85.4	82.6		87.4					1.8829	0.8599	NA
	128.6		137.2	101.6	118.2	112.8	113.6	123.8							
	111.2	111.4	114.8	123.4	119.6								2.8800	0.7319	NA
0.0	82.6	80.8	79.2	79.6	82.8										
	65.6		73.2	69.0	68.8	129.4	153.2						14.1771	0.6466	14.1
	125.4			126.2	134.6	192.2	167.4	176.4					8.9092	0.5959	22.4

Indicates the average year extrapolated from last correlatable data.

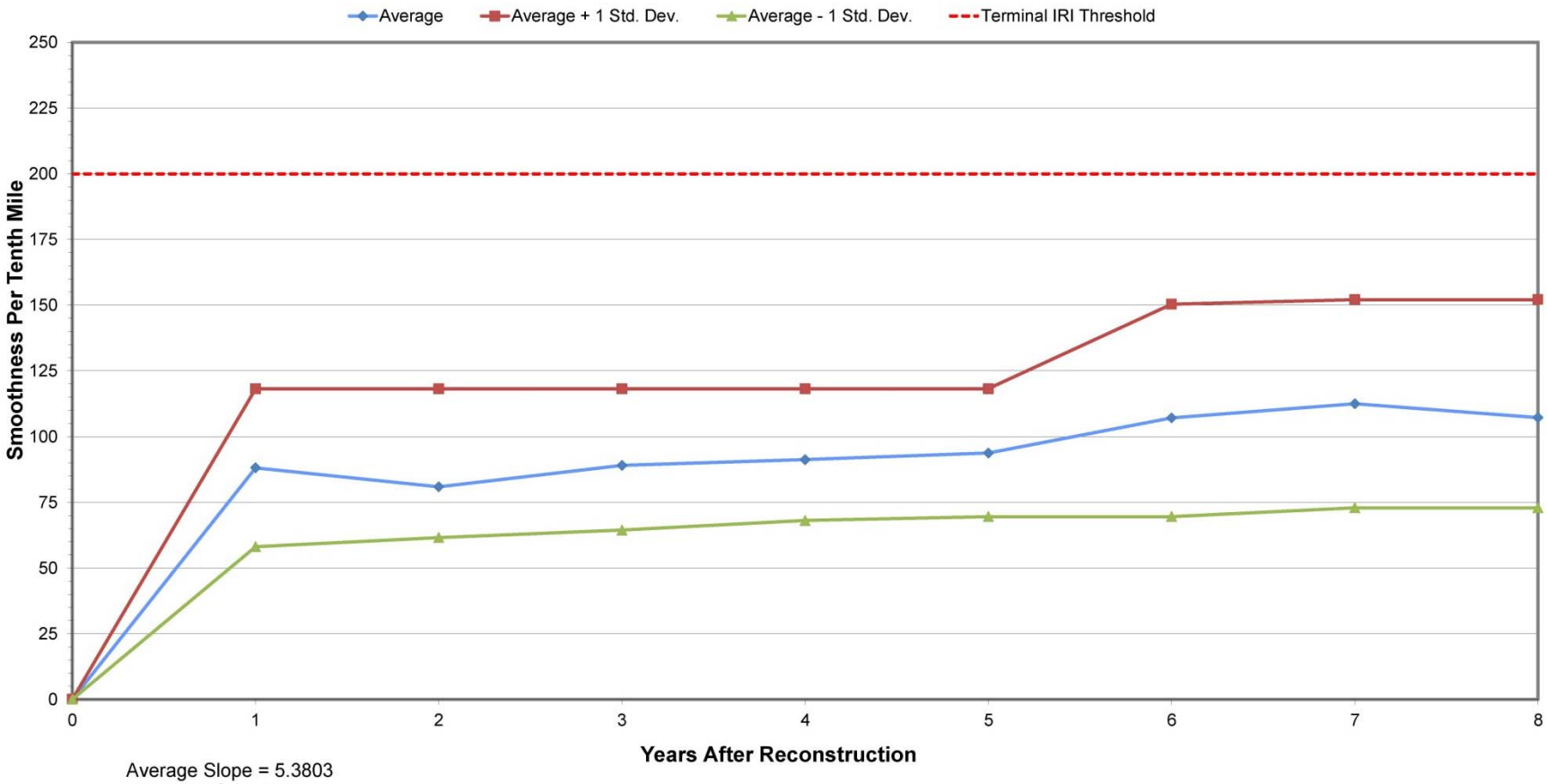
Average Years Until Rehabilitation **18.5**

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	88.1750	80.8800	89.0500	91.2750	93.7778	107.1714	112.5333	107.2800					**5.3803**	**0.6932**
Std. Dev.	0	30.0275	19.2804	24.6175	23.1891	24.1660	43.2180	39.5953	43.7784						
Ave + 1 Std. Dev.	0	118.2025	118.2025	118.2025	118.2025	118.2025	150.3894	152.1286	152.1286						
Ave - 1 Std. Dev.	0	58.1475	61.5996	64.4325	68.0859	69.6118	69.6118	72.9380	72.9380						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	8	5	8	8	9	7	6	5	0	0	0	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		

Terminal IRI and the Increase in IRI
Minor Arterials (2002-2013)



Average Slope = 5.3803
Average R^2 = 0.6932
Average Life = 25 Years
Minimum Life = 16 Years
Maximum Life = 31 Years

Terminal IRI and the Increase in IRI

Major Collectors (2002-2013)

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
	112.6	120.2	109.2	125.4	132.0								4.4000	0.5619	NA
		146.6		147.8											5.0
0.0	83.8	87.2	89.4	89.6	98.4								14.6171	0.5483	12.0
0.0	60.6	73.6	63.6	60.8	73.0								10.1600	0.4712	17.5
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		11.5

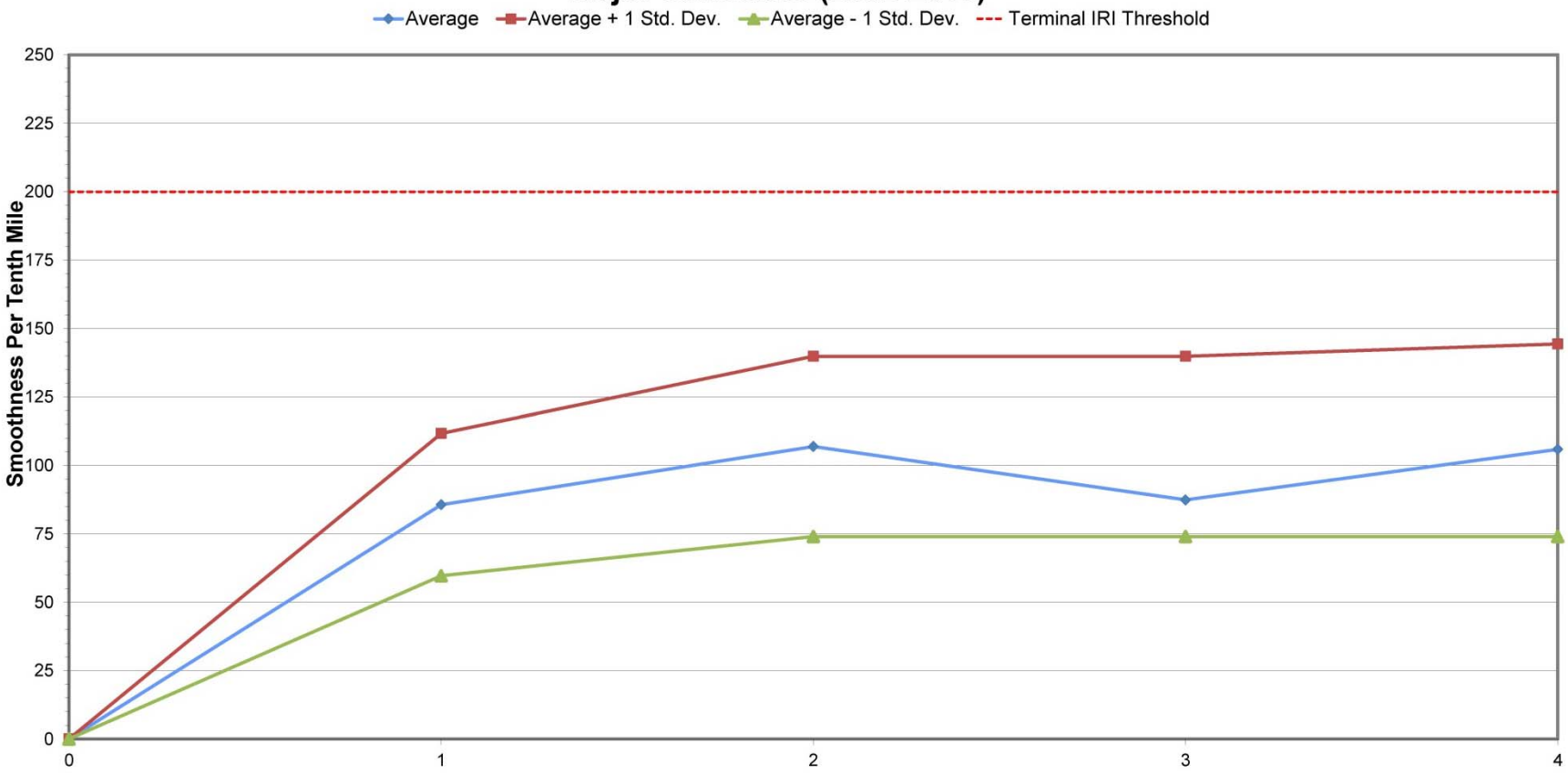
Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	85.6667	106.9000	87.4000	105.9000	101.1333								**9.7257**	**0.5272**
Std. Dev.	0	26.0502	32.9138	22.8657	38.4515	29.5948									
Ave + 1 Std. Dev.	0	111.7169	139.8138	139.8138	144.3515	144.3515									
Ave - 1 Std. Dev.	0	59.6165	73.9862	73.9862	73.9862	73.9862									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	3	4	3	4	3	0	0	0	0	0	0	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		

Terminal IRI and the Increase in IRI

Major Collectors (2002-2013)



Average Slope = 9.7257
Average R^2 = 0.5272
Average Life = 15 Years
Minimum Life = 10 Years
Maximum Life = 13 Years

Terminal IRI and the Increase in IRI

Statewide (2002-2013)

HWY	BMP	EMP	Length	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	81.6		82.6		86.2	88.4	86.2						1.0431	0.7948	7.0
	123.8		133.0		140.4		135.2	138.0	134.4				1.2295	0.4392	NA
119.5		137.0		124.6	123.0	110.8									
	112.6	120.2	109.2	125.4	132.0								4.4000	0.5619	NA
	94.4		101.4	91.2	122.2								5.0857	0.3886	5.0
	82.2	82.2	81.0	78.6	84.4								0.0800	0.0036	NA
		146.6		147.8		152.0	146.0	142.8	145.8	137.6					
	78.4	75.8	78.2	102.0	103.8								7.7000	0.7582	26.0
		0.0	0.0	65.8	66.2								26.4400	0.8024	7.6
						101.2	122.6	136.6	122.6	125.0	130.4		3.9771	0.3849	NA
							122.6	123.6	166.2		198.2		20.6000	0.9271	9.7
				144.4	126.8	129.0	159.4	189.2					12.2200	0.5666	8.0
	124.2	126.2	120.2	126.8	139.2	127.0	130.2						1.3786	0.2527	7.0
	121.4	129.2	130.2		157.6	152.0	159.2	180.0					7.6247	0.9222	26.2
	99.0	109.0	89.2	91.4	92.2	95.8	100.0	102.2	96.2	97.4	103.6		0.2455	0.0196	NA
	73.4	73.8		75.6	78.8	74.6	74.0	155.0	180.2				11.1973	0.5275	17.9
71.8		95.6	89.4	66.2	97.8	67.0	71.0	204.0	127.2				7.8081	0.2701	25.6
	58.6	112.2		104.0	109.0	115.8	129.6	139.6					8.5841	0.7304	23.3
	71.8	74.4	70.4	61.4	60.2										
	66.6	68.6	65.4	69.0	69.6								0.6400	0.3274	NA
		52.0	51.6	58.6	58.0								2.5000	0.7351	NA
	93.2	99.2	88.8	102.0	104.0	111.8	106.8	175.4					8.1476	0.5322	24.5
	81.8	84.8	86.8	97.6	95.6	97.4	96.8	95.6					2.2190	0.7074	NA
	81.0	60.8	71.2	74.6	93.2	76.2	115.6	142.4					8.7786	0.6318	8.0
	62.4	79.4	67.8	68.0	71.4	68.8	183.6	185.0					16.4952	0.5748	8.0
	51.8	53.2	59.2	58.2	57.4		69.6						2.6429	0.8250	NA
	72.6	61.2	68.4	62.0	61.6	66.4	205.2						14.3357	0.3412	14.0
	54.0	78.4	85.2	83.4	81.4	78.6	79.8	79.8					1.9738	0.2427	NA
	56.4	58.0	61.8	67.2	67.0	66.2	75.0	69.0					2.2167	0.7955	NA
		75.8	78.4	79.8	85.4	82.6		87.4	81.4				1.0986	0.4945	NA
	128.6		137.2	101.6	118.2	112.8	113.6	123.8	123.8						
133.2	202.4		204.0	195.4	180.4	245.0	225.0	225.8					9.0414	0.5540	8.0
	146.4		147.8		167.2	157.2	163.0	173.6	172.6				3.5365	0.8092	NA
97.8			69.4		138.4		179.8		190.0	165.6			10.6421	0.7021	10.0
		68.2		147.2	74.8	158.2		160.8	173.6				13.8400	0.5909	9.0
	66.8		106.2		126.8	130.0	133.6	151.6	127.8				8.4251	0.7680	23.7
	71.2		105.2		93.4	138.6	128.2	142.0	123.6				7.5826	0.6834	26.4
59.8			87.8	70.4			93.2	110.4	86.6				3.9824	0.5941	NA
	93.8		139.0	145.8	143.4	107.6	109.0						0.8143	0.0062	NA
	64.6	67.2	68.4	77.2	101.8	94.8	97.8	104.2					6.3571	0.8580	25.2
	65.2	65.6	65.2	68.6	68.4	70.0	72.0	84.2					2.1333	0.6938	75.0
	90.8	88.8	93.4	83.4	114.8	92.4	99.0	116.6	137.4				4.8333	0.5719	33.1
	100.0	97.4	98.8	97.6	104.8	105.4	108.4	117.0	120.8				2.8167	0.8231	NA
	83.8	87.2	89.4	89.6	98.4	127.6	118.8	124.8	119.0	129.2			5.6061	0.8274	NA
	60.6	73.6	63.6	60.8	73.0	0.0	90.4	101.4	137.0	213.4			12.2655	0.4344	23.8
	111.2	111.4	114.8	123.4	119.6								2.8800	0.7319	NA
	82.6	80.8	79.2	79.6	82.8										
		65.8		69.0	67.8	65.2	75.0	66.4					0.4971	0.0887	NA
	72.4	79.8	116.4	126.6	156.8	163.8							19.9486	0.9661	10.0
	79.4	81.8	105.8	111.6	138.8								14.8600	0.9322	13.5
	65.6		73.2	69.0	68.8	129.4	153.2						14.1771	0.6466	14.1
	74.6	69.4	75.4	78.0									1.6200	0.3365	NA
	88.8		85.4		83.8	89.8	89.2	129.0					3.8000	0.3340	8.0
	104.4		100.2		108.4	105.6	103.8	104.8	103.2				0.1054	0.0143	NA
	88.6		98.6		91.8		113.0	128.0		152.8	133.4		5.9097	0.8083	33.8
		84.4		98.0		104.0	116.8	102.4	110.6	111.4			3.1359	0.6851	NA
	69.0	65.2	70.4	72.2									1.4800	0.4136	NA
	125.4			126.2	134.6	192.2	167.4	176.4					8.9092	0.5959	22.4
													Average Years Until Rehabilitation		18.5

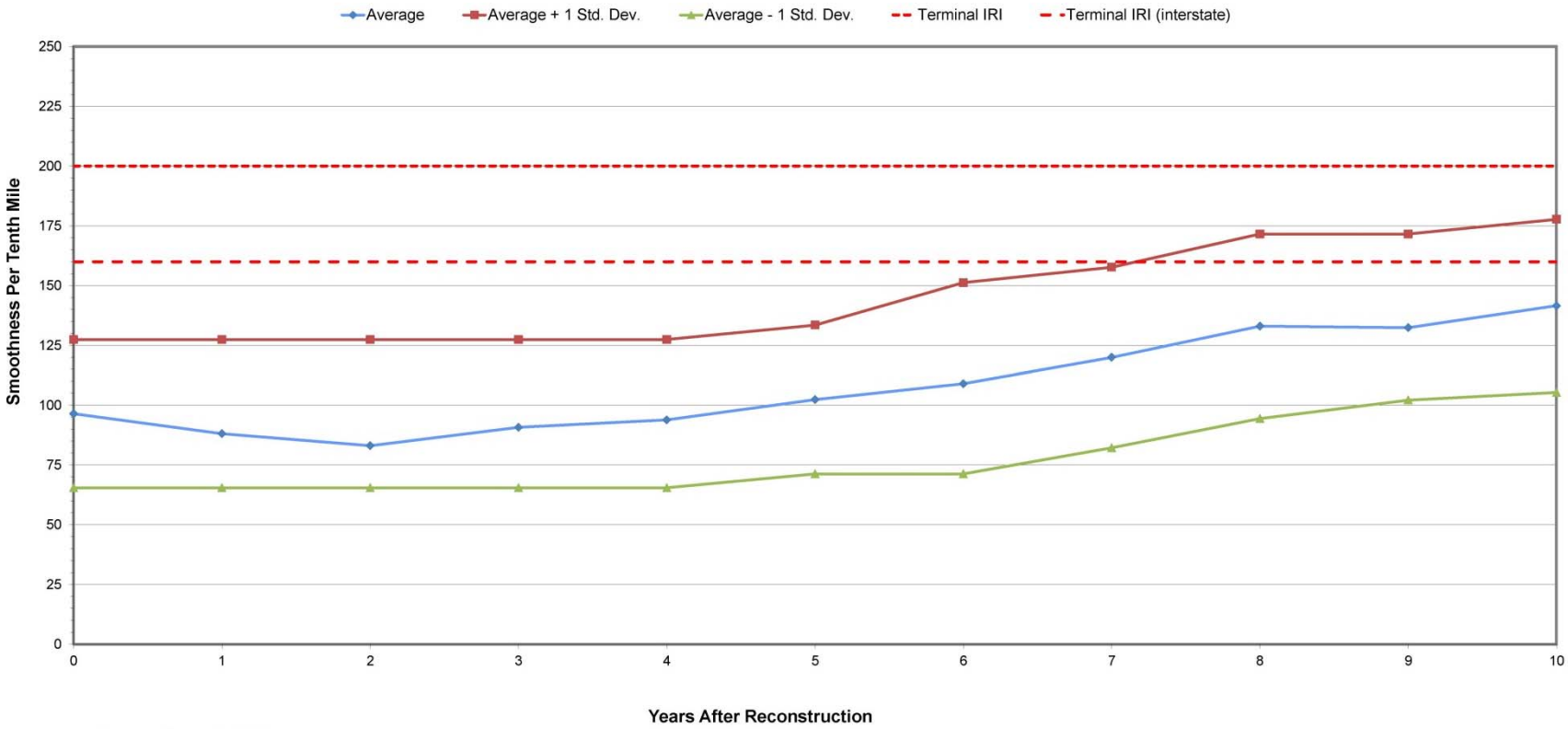
Note 1 : Roadways classified as an interstate have a terminal IRI of 160, thus for interstates an IRI value of 160 was used for calculating the average year until rehabilitation; an IRI value of 200 was used for all other roadways.

Indicates the average year extrapolated from last correlatable data.

Explanation
Original data
Deleted data (anomaly)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	96.4200	88.1227	83.0821	90.7277	93.8435	102.3804	109.0051	119.9659	133.0222	132.3810	141.5500	141.4000		6.6012	0.5666
Std. Dev.	30.9618	28.6948	27.0841	31.4262	30.6322	31.0865	42.1953	37.7356	38.5636	30.1952	36.1893	40.1667			
Ave + 1 Std. Dev.	127.3818	127.3818	127.3818	127.3818	127.3818	133.4689	151.2005	157.7014	171.5858	171.5858	177.7393	181.5667			
Ave - 1 Std. Dev.	65.4582	65.4582	65.4582	65.4582	65.4582	71.2938	71.2938	82.2303	94.4586	102.1858	105.3607	105.3607			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	5	44	39	47	46	51	39	41	36	21	8	4	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		
Terminal IRI (interstate)	160	160	160	160	160	160	160	160	160	160	160	160	160		

Terminal IRI and the Increase in IRI
Statewide Average (2002-2013)



Average Slope = 6.6012
Average R^2 = 0.5666
Average Life for Interstates = 13 Years
Minimum Life for Interstates = 7 Years
Maximum Life for Interstates = 19 Years

Average Life of Other Roadways = 19 Years
Minimum Life of Other Roadways =13 Years
Maximum Life of Other Roadways = 25 Years

Note: A terminal IRI of 160 was used to calculate the average, minimum and maximum years for interstates, and a terminal IRI of 200 was used to calculate the average, minimum and maximium years for principal arterials, minor arterials and major collectors.

Terminal IRI and the Increase in IRI
Interstates (2007-2013)

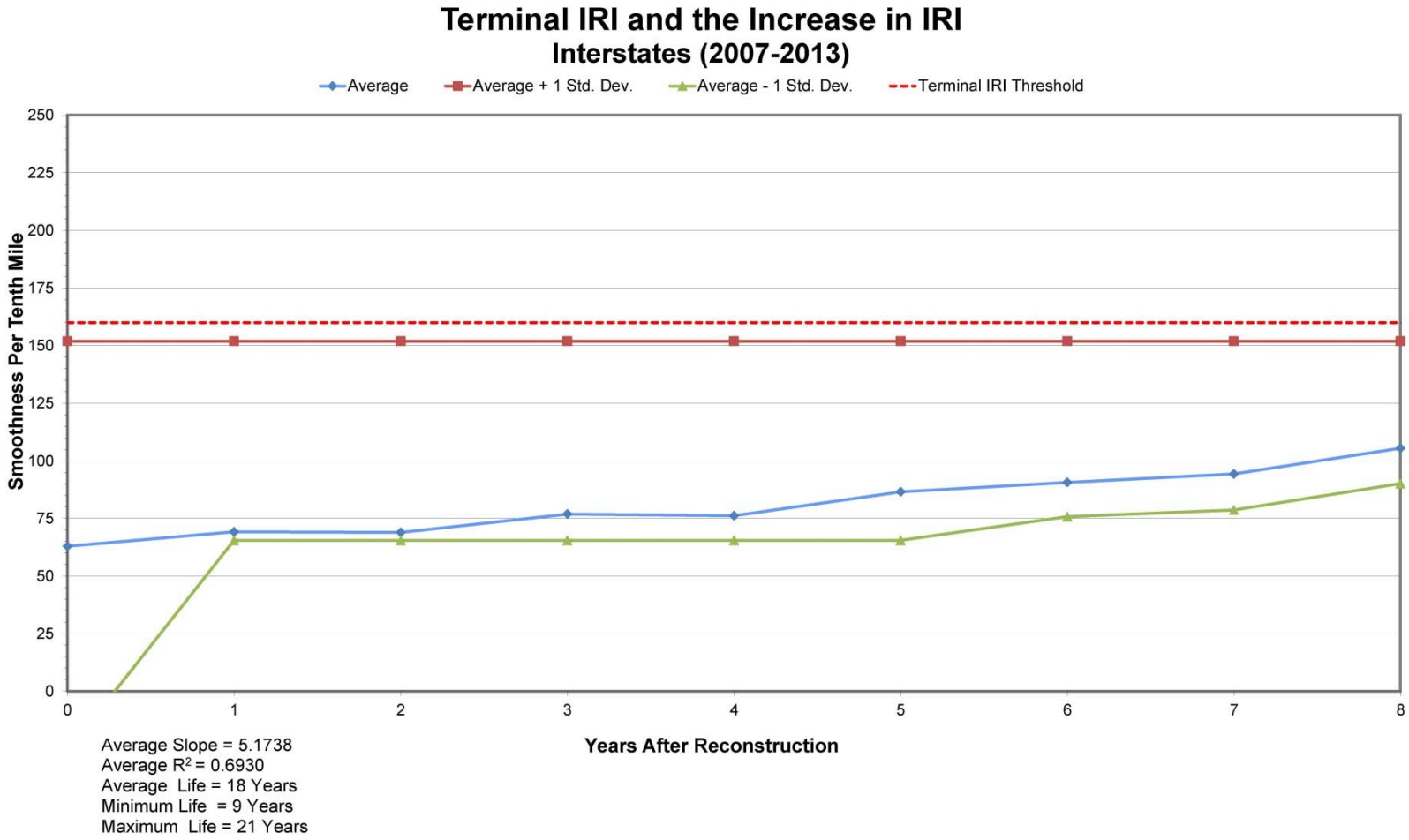
Highway	Starting MM	Ending MP	Length (miles)	Direction
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs Until Rehab
125.8	71.8	74.4	70.4	61.4	60.2										NA
	66.6	68.6	65.4	69.0	69.6								0.6400	0.3274	NA
		67.2	68.4	77.2	101.8	94.8	97.8	104.2					6.6929	0.8221	23.9
		65.6	65.2	68.6	68.4	70.0	72.0	84.2					2.5286	0.7153	NA
0.0			93.4	83.4	114.8	92.4	99.0	116.6					12.4645	0.7153	11.0
			98.8	97.6	104.8	105.4	108.4	117.0					3.5429	0.8847	20.1
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		18.3

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	13		
Average	62.9000	69.2000	68.9500	76.9333	76.2000	86.6000	90.6500	94.3000	105.5000					**5.1738**	**0.6930**
Std. Dev.	88.9540	3.6770	3.8345	15.0698	12.9572	23.1289	14.8803	15.6038	15.3931						
Ave + 1 Std. Dev.	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540	151.8540						
Ave - 1 Std. Dev.	-26.0540	65.5230	65.5230	65.5230	65.5230	65.5230	75.7697	78.6962	90.1069						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	2	4	6	6	6	4	4	4	0	0	0	0		
Terminal IRI	160	160	160	160	160	160	160	160	160	160	160	160	160		


Terminal IRI and the Increase in IRI
Interstates (2007-2013)
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal IRI Threshold
Smoothness Per Tenth Mile
250
225
200
175
150
125
100
75
50
25
0
0
1
2
3
4
5
6
7
8
Years After Reconstruction
Average Slope = 5.1738
Average R² = 0.6930
Average Life = 18 Years
Minimum Life = 9 Years
Maximum Life = 21 Years

Terminal IRI and the Increase in IRI

Principal Arterials (2007-2013)

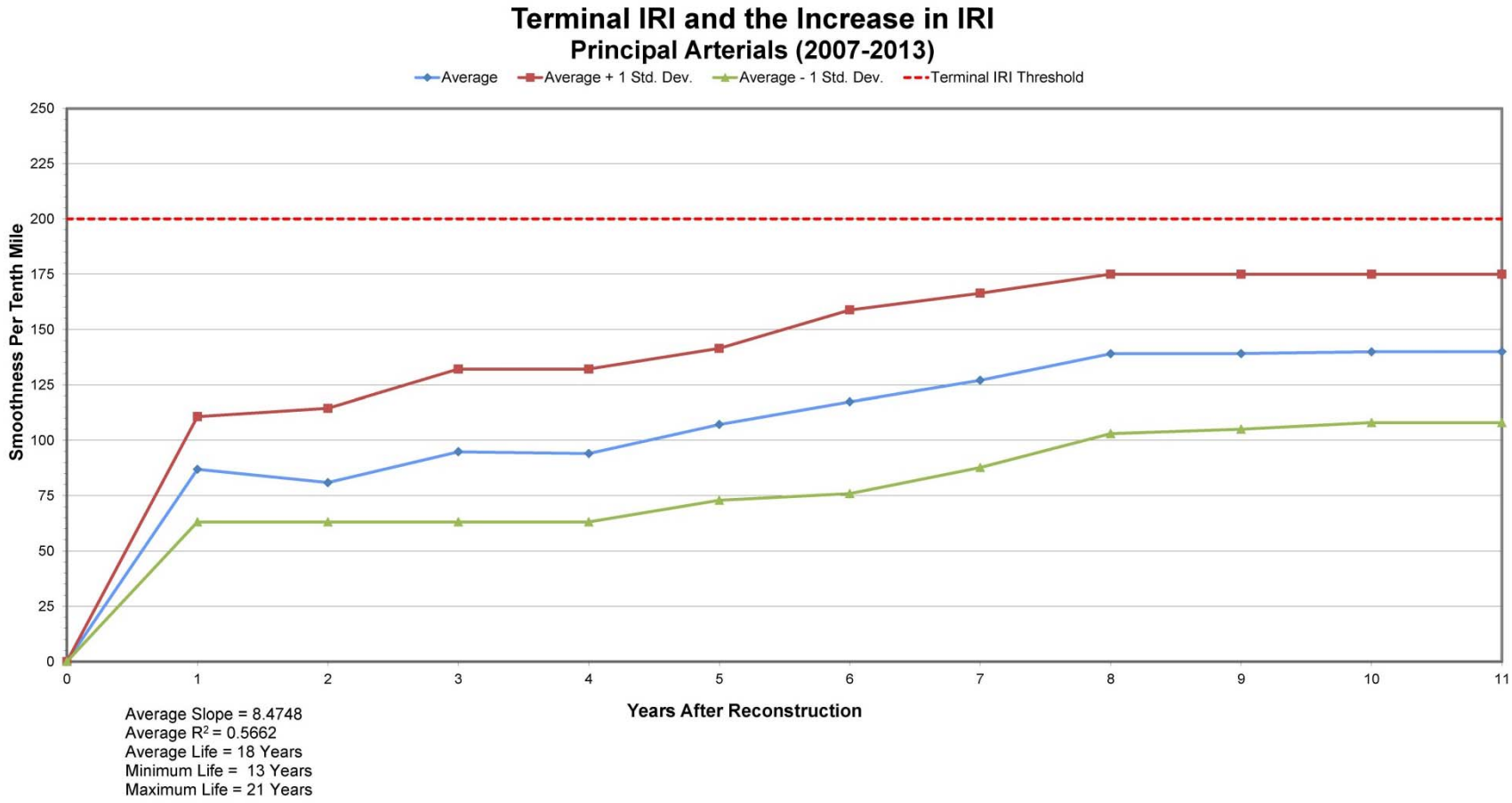
Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
	123.2		123.8		133.0		140.4		135.2	138.0	134.4		1.4253	0.6394	NA
		137.0		124.6	123.0	110.8									
			101.4	91.2	122.2								10.4000	0.4333	5.0
	82.2	82.2	81.0	78.6	84.4								0.0800	0.0036	NA
	78.4	75.8	78.2	102.0	103.8								7.7000	0.7582	26.0
		0.0	0.0	65.8	66.2								26.4400	0.8024	7.6
						101.2	122.6	136.6	122.6	125.0	130.4		3.9771	0.3849	NA
0.0							122.6	123.6	166.2		198.2		17.8400	0.9837	11.2
0.0						144.4	126.8	129.0	159.4	189.2			17.6937	0.9298	10.0
	124.2	126.2	120.2	126.8	139.2	127.0	130.2						1.3786	0.2527	7.0
	121.4	129.2	130.2		157.6	152.0	159.2	180.0					7.6247	0.9222	26.2
					92.2	95.8	100.0	102.2	96.2	97.4	103.6		1.2000	0.4253	NA
				75.6	78.8	74.6	74.0	155.0	180.2				21.4571	0.6958	9.3
			89.4												
		112.2		104.0	109.0	115.8	129.6	139.6					4.9914	0.6348	NA
		52.0	51.6	58.6	58.0								2.5000	0.7351	NA
		99.2	88.8	102.0	104.0	111.8	106.8	175.4					9.8000	0.5476	20.4
		84.8	86.8	97.6	95.6	97.4	96.8	95.6					1.8643	0.5648	NA
			71.2	74.6	93.2	76.2	115.6	142.4					13.2000	0.7606	8.0
			67.8	68.0	71.4	68.8	183.6	185.0					26.5771	0.6970	8.0
	51.8	53.2	59.2	58.2	57.4		69.6						2.6429	0.8250	NA
	72.6	61.2	68.4	62.0	61.6	66.4	205.2						14.3357	0.3412	14.0
			204.0	195.4	180.4	245.0	225.0	225.8					7.4971	0.3533	8.0
			147.8		167.2	157.2	163.0	173.6	172.6				3.8686	0.7201	NA
					138.4		179.8		190.0	165.6			6.4169	0.4037	10.0
					74.8	158.2		160.8	173.6				20.0200	0.6538	9.0
			106.2		126.8	130.0	133.6	151.6	127.8				4.9771	0.5461	NA
			105.2		93.4	138.6	128.2	142.0	123.6				5.5857	0.4008	35.8
			87.8	70.4			93.2	110.4	86.6				2.9821	0.2884	NA
	93.8		139.0	145.8	143.4								13.0857	0.8234	5.0
		65.8		69.0	67.8	65.2	75.0	66.4					0.4971	0.0887	NA
	72.4	79.8	116.4	126.6	156.8	163.8							19.9486	0.9661	10.0
	79.4	81.8	105.8	111.6	138.8								14.8600	0.9322	13.5
	74.6	69.4	75.4	78.0									1.6200	0.3365	NA
			85.4		83.8	89.8	89.2	129.0					6.9351	0.4966	8.0
			100.2		108.4	105.6	103.8	104.8	103.2				0.2286	0.0329	NA
					91.8		113.0	128.0		152.8	133.4		8.4912	0.7860	23.6
				98.0		104.0	116.8	102.4	110.6	111.4			1.9457	0.3692	NA
	69.0	65.2	70.4	72.2									1.4800	0.4136	NA
													Average Years Until Rehabilitation		13.1

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	86.9167	80.8824	94.8741	94.0250	107.1742	117.3739	127.0615	139.0545	139.1286	139.9143	140.0000		**8.4748**	**0.5662**
Std. Dev.	0.0000	23.7714	33.5725	37.2789	32.6443	34.2626	41.4586	39.3548	35.9655	34.0725	31.8892	34.9259			
Ave + 1 Std. Dev.	0.0000	110.6881	114.4549	132.1530	132.1530	141.4368	158.8326	166.4164	175.0200	175.0200	175.0200	175.0200			
Ave - 1 Std. Dev.	0.0000	63.1453	63.1453	63.1453	63.1453	72.9116	75.9153	87.7067	103.0890	105.0561	108.0251	108.0251			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	12	17	27	24	31	23	26	22	14	7	5	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		


Terminal IRI and the Increase in IRI
Principal Arterials (2007-2013)
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal IRI Threshold
Smoothness Per Tenth Mile
250
225
200
175
150
125
100
75
50
25
0
0
1
2
3
4
5
6
7
8
9
10
11
Years After Reconstruction
Average Slope = 8.4748
Average R² = 0.5662
Average Life = 18 Years
Minimum Life = 13 Years
Maximum Life = 21 Years

Terminal IRI and the Increase in IRI

Minor Arterials (2007-2013)

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

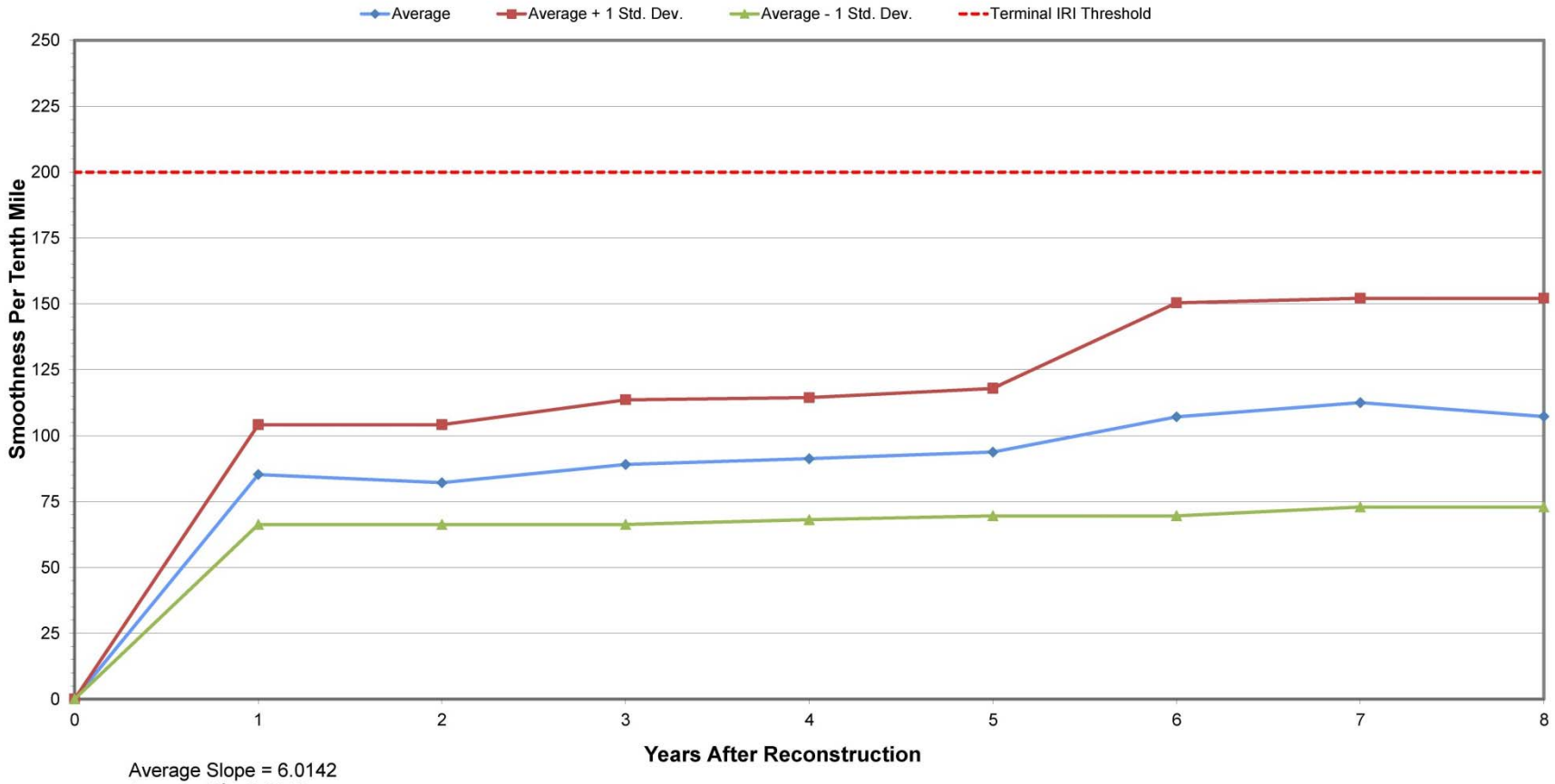
IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Years Until Rehab
	81.6		82.6		86.2	88.4	86.2						1.0431	0.7948	7.0
0.0		78.4	85.2	83.4	81.4	78.6	79.8	79.8					6.8717	0.4080	29.1
		58.0	61.8	67.2	67.0	66.2	75.0	69.0					2.0857	0.7023	NA
			78.4	79.8	85.4	82.6		87.4					1.7216	0.7793	NA
			137.2	101.6	118.2	112.8	113.6	123.8							
	111.2	111.4	114.8	123.4	119.6								2.8800	0.7319	NA
0.0	82.6	80.8	79.2	79.6	82.8										
	65.6		73.2	69.0	68.8	129.4	153.2						14.1771	0.6466	14.1
				126.2	134.6	192.2	167.4	176.4					13.3200	0.5639	15.0
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		16.3

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	85.2500	82.1500	89.0500	91.2750	93.7778	107.1714	112.5333	107.2800					**6.0142**	**0.6610**
Std. Dev.	0	18.9725	22.0202	24.6175	23.1891	24.1660	43.2180	39.5953	43.7784						
Ave + 1 Std. Dev.	0	104.2225	104.2225	113.6675	114.4641	117.9438	150.3894	152.1286	152.1286						
Ave - 1 Std. Dev.	0	66.2775	66.2775	66.2775	68.0859	69.6118	69.6118	72.9380	72.9380						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	4	4	8	8	9	7	6	5	0	0	0	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		

Terminal IRI and the Increase in IRI
Minor Arterials (2007-2013)



Average Slope = 6.0142
Average R^2 = 0.6610
Average Life = 23 Years
Minimum Life = 15 Years
Maximum Life = 29 Years

Terminal IRI and the Increase in IRI

Major Collectors (2007-2013)

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

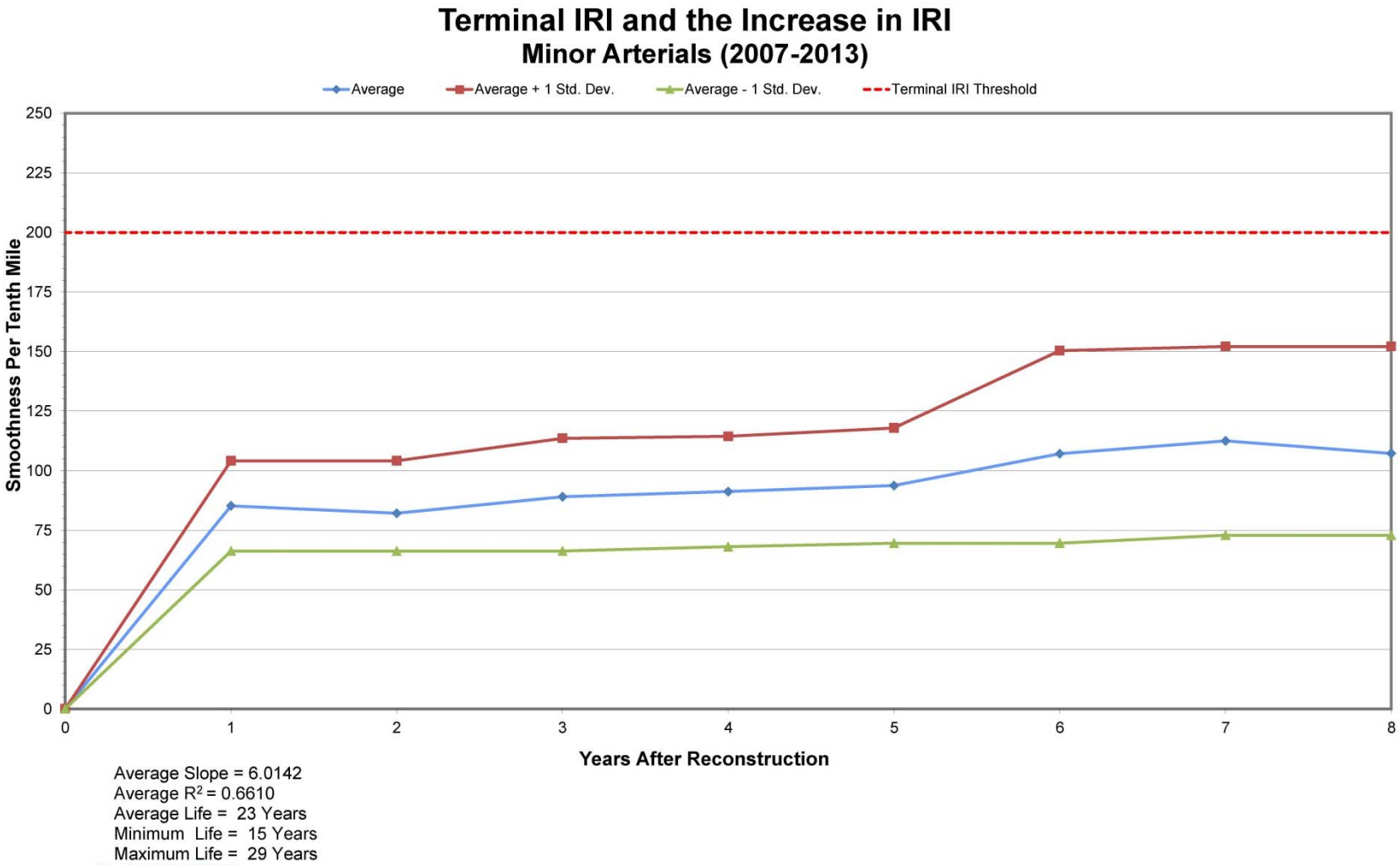
IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
				125.4	132.0								6.6000	1.0000	NA
				147.8											5.0
0.0				89.6	98.4								20.4571	0.9881	12.0
0.0				60.8	73.0								14.7714	0.9989	17.5
													Average Years Until Rehabilitation		11.5

Indicates the average year extrapolated from last correlatable data.

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	#DIV/0!	#DIV/0!	#DIV/0!	105.9000	101.1333								**13.9429**	**0.9957**
Std. Dev.	0	#DIV/0!	#DIV/0!	#DIV/0!	38.4515	29.5948									
Ave + 1 Std. Dev.	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!									
Ave - 1 Std. Dev.	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	0	0	0	4	3	0	0	0	0	0	0	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		


Terminal IRI and the Increase in IRI
Minor Arterials (2007-2013)
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal IRI Threshold
Smoothness Per Tenth Mile
250
225
200
175
150
125
100
75
50
25
0
0
1
2
3
4
5
6
7
8
Years After Reconstruction
Average Slope = 6.0142
Average R² = 0.6610
Average Life = 23 Years
Minimum Life = 15 Years
Maximum Life = 29 Years

Terminal IRI and the Increase in IRI

Statewide (2007-2013)

HWY	BMP	EMP	Length	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

IRI															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	81.6		82.6		86.2	88.4	86.2						1.0431	0.7948	7.0
			133.0		140.4		135.2	138.0	134.4				0.1121	0.0082	NA
119.5		137.0		124.6	123.0	110.8									
	112.6	120.2	109.2	125.4	132.0								4.4000	0.5619	NA
			101.4	91.2	122.2								10.4000	0.4333	5.0
	82.2	82.2	81.0	78.6	84.4								0.0800	0.0036	NA
				147.8		152.0	146.0	142.8	145.8	137.6					
	78.4	75.8	78.2	102.0	103.8								7.7000	0.7582	26.0
		0.0	0.0	65.8	66.2								26.4400	0.8024	7.6
						101.2	122.6	136.6	122.6	125.0	130.4		3.9771	0.3849	NA
							122.6	123.6	166.2		198.2		20.6000	0.9271	9.7
				144.4	126.8	129.0	159.4	189.2					12.2200	0.5666	8.0
	124.2	126.2	120.2	126.8	139.2	127.0	130.2						1.3786	0.2527	7.0
	121.4	129.2	130.2		157.6	152.0	159.2	180.0					7.6247	0.9222	26.2
					92.2	95.8	100.0	102.2	96.2	97.4	103.6		1.2000	0.4253	NA
				75.6	78.8	74.6	74.0	155.0	180.2				21.4571	0.6958	9.3
0.0			89.4	66.2	97.8	67.0	71.0	204.0	127.2				15.1958	0.5726	13.2
		112.2		104.0	109.0	115.8	129.6	139.6					4.9914	0.6348	NA
	71.8	74.4	70.4	61.4	60.2										
	66.6	68.6	65.4	69.0	69.6								0.6400	0.3274	NA
		52.0	51.6	58.6	58.0								2.5000	0.7351	NA
		99.2	88.8	102.0	104.0	111.8	106.8	175.4					9.8000	0.5476	20.4
		84.8	86.8	97.6	95.6	97.4	96.8	95.6					1.8643	0.5648	NA
			71.2	74.6	93.2	76.2	115.6	142.4					13.2000	0.7606	8.0
			67.8	68.0	71.4	68.8	183.6	185.0					26.5771	0.6970	8.0
	51.8	53.2	59.2	58.2	57.4		69.6						2.6429	0.8250	NA
	72.6	61.2	68.4	62.0	61.6	66.4	205.2						14.3357	0.3412	14.0
		78.4	85.2	83.4	81.4	78.6	79.8	79.8					-0.4071	0.1192	NA
		58.0	61.8	67.2	67.0	66.2	75.0	69.0					2.0857	0.7023	NA
			78.4	79.8	85.4	82.6		87.4	81.4				0.7938	0.2928	NA
			137.2	101.6	118.2	112.8	113.6	123.8	123.8						
0.0			204.0	195.4	180.4	245.0	225.0	225.8					26.0993	0.7124	8.0
			147.8		167.2	157.2	163.0	173.6	172.6				3.8686	0.7201	NA
0.0					138.4		179.8		190.0	165.6			18.1376	0.8535	10.0
				147.2	74.8	158.2		160.8	173.6				10.8930	0.3317	9.0
			106.2		126.8	130.0	133.6	151.6	127.8				4.9771	0.5461	NA
			105.2		93.4	138.6	128.2	142.0	123.6				5.5857	0.4008	35.8
0.0			87.8	70.4			93.2	110.4	86.6				9.2340	0.6663	NA
	93.8		139.0	145.8	143.4	107.6	109.0						0.8143	0.0062	NA
		67.2	68.4	77.2	101.8	94.8	97.8	104.2					6.6929	0.8221	23.9
		65.6	65.2	68.6	68.4	70.0	72.0	84.2					2.5286	0.7153	NA
			93.4	83.4	114.8	92.4	99.0	116.6	137.4				6.5214	0.5737	24.5
			98.8	97.6	104.8	105.4	108.4	117.0	120.8				3.8714	0.9257	NA
				89.6	98.4	127.6	118.8	124.8	119.0	129.2			5.6143	0.6274	NA
				60.8	73.0	0.0	90.4	101.4	137.0	213.4			24.5429	0.6363	23.8
	111.2	111.4	114.8	123.4	119.6								2.8800	0.7319	NA
	82.6	80.8	79.2	79.6	82.8										
		65.8		69.0	67.8	65.2	75.0	66.4					0.4971	0.0887	NA
	72.4	79.8	116.4	126.6	156.8	163.8							19.9486	0.9661	10.0
	79.4	81.8	105.8	111.6	138.8								14.8600	0.9322	13.5
	65.6		73.2	69.0	68.8	129.4	153.2						14.1771	0.6466	14.1
	74.6	69.4	75.4	78.0									1.6200	0.3365	NA
			85.4		83.8	89.8	89.2	129.0					6.9351	0.4966	8.0
			100.2		108.4	105.6	103.8	104.8	103.2				0.2286	0.0329	NA
					91.8		113.0	128.0		152.8	133.4		8.4912	0.7860	23.6
				98.0		104.0	116.8	102.4	110.6	111.4			1.9457	0.3692	NA
	69.0	65.2	70.4	72.2									1.4800	0.4136	NA
				126.2	134.6	192.2	167.4	176.4					13.3200	0.5639	15.0
													Average Years Until Rehabilitation		14.4

Note 1 : Roadways classified as an interstate have a terminal IRI of 160, thus for interstates an IRI value of 160 was used for calculating the average year until rehabilitation; an IRI value of 200 was used for all other roadways.

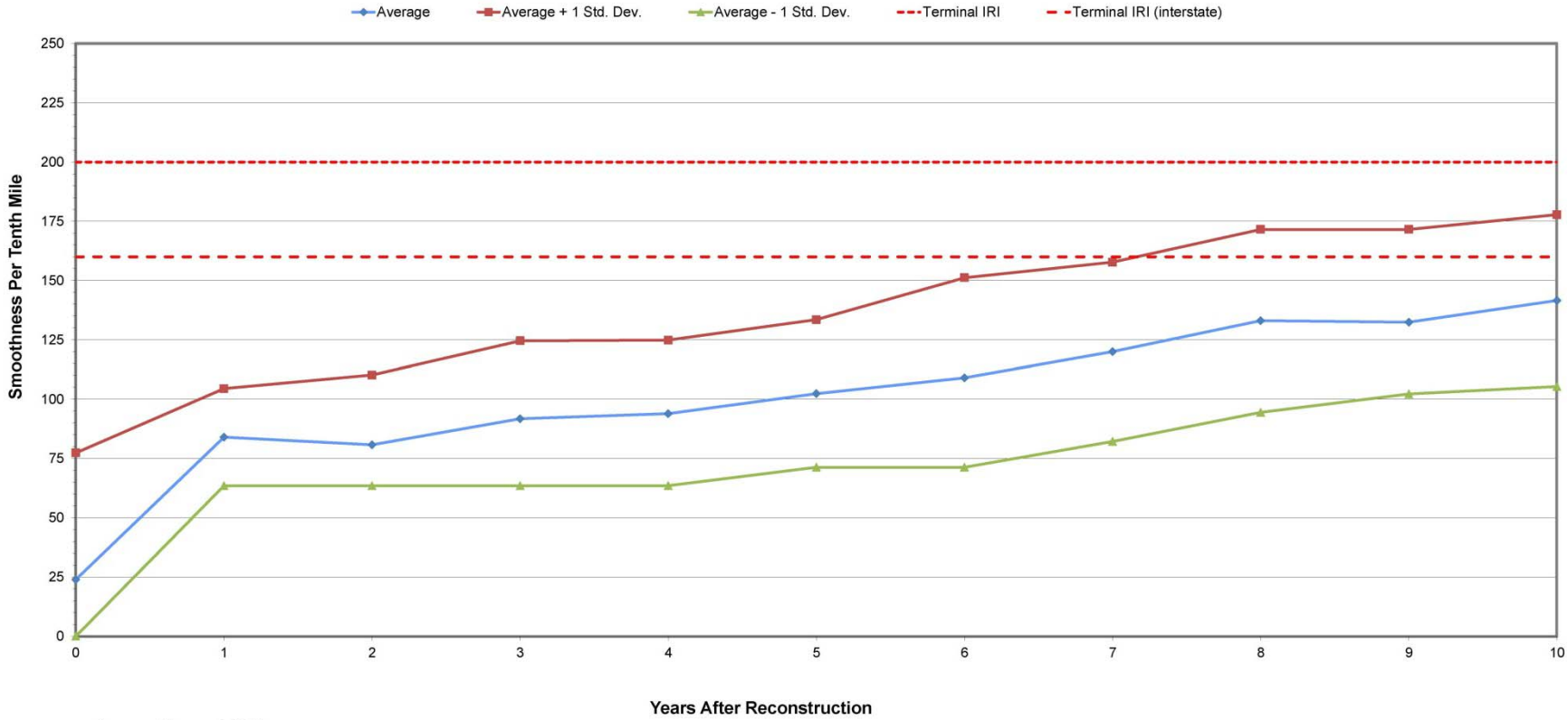
Indicates the average year extrapolated from last correlatable data.

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction												Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	23.9000	83.9889	80.7538	91.7619	93.8978	102.3804	109.0051	119.9659	133.0222	132.3810	141.5500	141.4000		0.8871	0.5577
Std. Dev.	53.4420	20.4896	29.4306	32.8070	30.9761	31.0865	42.1953	37.7356	38.5636	30.1952	36.1893	40.1667			
Ave + 1 Std. Dev.	77.3420	104.4785	110.1845	124.5689	124.8739	133.4669	151.2005	157.7014	171.5858	171.5858	177.7393	181.5667			
Ave - 1 Std. Dev.	0.0000	63.4993	63.4993	63.4993	63.4993	71.2938	71.2938	82.2303	94.4586	102.1858	105.3607	105.3607			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	5	18	26	42	45	51	39	41	36	21	8	4	0		
Terminal IRI	200	200	200	200	200	200	200	200	200	200	200	200	200		
Terminal IRI (interstate)	160	160	160	160	160	160	160	160	160	160	160	160	160		

Terminal IRI and the Increase in IRI
Statewide Average (2007-2013)



Average Slope = 8.0871
Average R^2 = 0.5577
Average Life for Interstates = 13 Years
Minimum Life for Interstates = 7 Years
Maximum Life for Interstates = 17 Years

Average Life of Other Roadways = 18 Years
Minimum Life of Other Roadways =13 Years
Maximum Life of Other Roadways = 22 Years

Note: A terminal IRI of 160 was used to calculate the average, minimum and maximum years for interstates, and a terminal IRI of 200 was used to calculate the average, minimum and maximium years for principal arterials, minor arterials and major collectors.

Increase in Permanent Deformation and the Threshold

Interstates

Highway	Starting MM	Ending MM	Length (miles)	Direction
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2

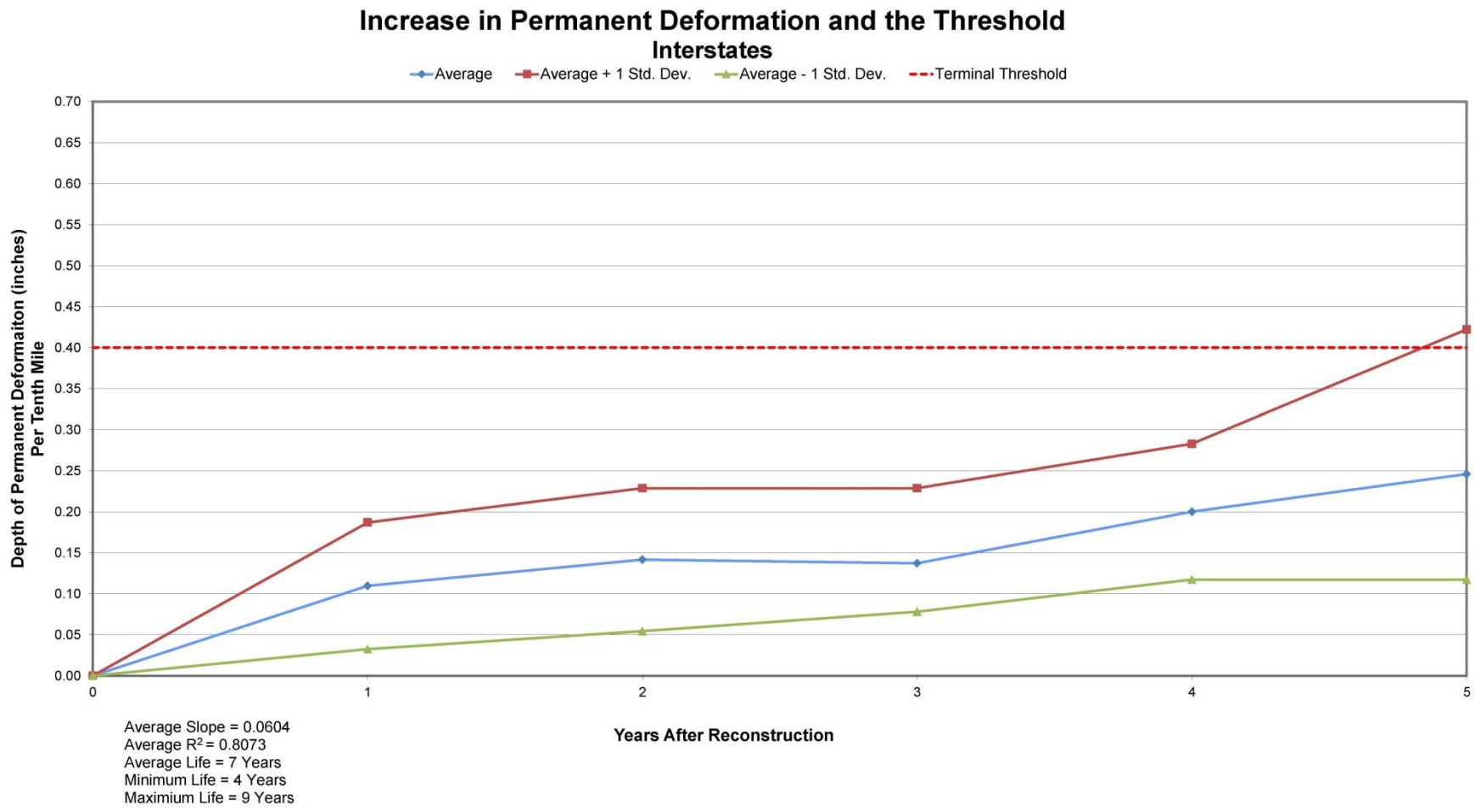
Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

Permanent Deformation

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
0.000	0.052	0.116	0.056	0.174	0.214								0.0393	0.8210	10.2
	0.000	0.000	0.126	0.264	0.436								0.1136	0.9270	3.5
	0.086		0.114	0.078	0.088										
0.000	0.200	0.200											0.1000	0.7500	2.0
	0.140	0.182	0.190	0.196									0.0176	0.8050	4.0
	0.180	0.210	0.200	0.288									0.0314	0.7333	4.0
Indicates the average year extrapolated from last correlatable data.													Average Years Until Rehabilitation		4.7

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.1097	0.1416	0.1372	0.2000	0.2460								**0.0604**	**0.8073**
Std. Dev.	0.0000	0.0774	0.0872	0.0591	0.0828	0.1762									
Ave + 1 Std. Dev.	0.0000	0.1870	0.2288	0.2288	0.2828	0.4222									
Ave - 1 Std. Dev.	0.0000	0.0323	0.0544	0.0781	0.1172	0.1172									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	6	5	5	5	3	0	0	0	0	0	0	0		
Terminal Threshold	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		


Increase in Permanent Deformation and the Threshold
Interstates
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Depth of Permanent Deformaiton (inches) Per Tenth Mile
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
4
5
Years After Reconstruction
Average Slope = 0.0604
Average R² = 0.8073
Average Life = 7 Years
Minimum Life = 4 Years
Maximium Life = 9 Years

Increase in Permanent Deformation and the Threshold

Principal Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

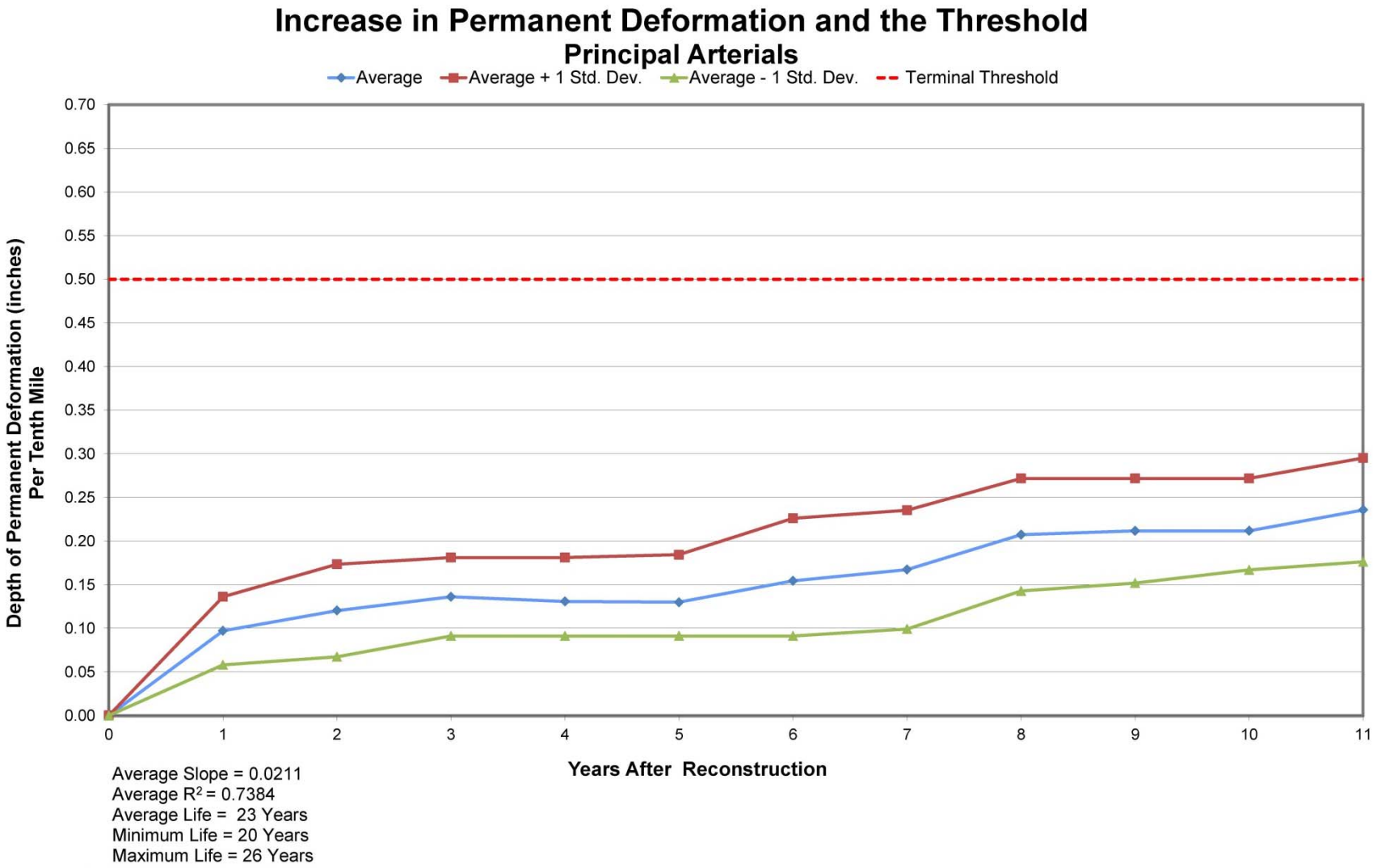
Permanent Deformation

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.084		0.086		0.110		0.108		0.152	0.148	0.182		0.0093	0.8861	NA
		0.083		0.126	0.148	0.152							0.0183	0.9586	27.4
	0.128			0.158	0.094		0.204	0.226	0.202				0.0127	0.5361	39.4
	0.056	0.090	0.166	0.168	0.226								0.0418	0.9493	12.0
	0.034	0.082	0.114	0.194	0.212								0.0468	0.9710	10.7
	0.056	0.104	0.118	0.132	0.148								0.0212	0.9114	23.6
							0.120	0.138	0.156	0.216	0.248		0.0334	0.9483	15.0
							0.146	0.140	0.178	0.294	0.328		0.0518	0.8729	9.7
							0.078	0.110	0.132	0.186	0.170		0.0260	0.8769	19.2
	0.140	0.202	0.208		0.136	0.298	0.270	0.296					0.0194	0.5540	25.8
	0.150	0.198	0.254			0.280	0.256	0.268					0.0144	0.6867	34.8
	0.094		0.148	0.180	0.220	0.250							0.0316	0.9944	6.0
	0.100	0.100	0.112	0.166									0.0210	0.7402	4.0
	0.060	0.142	0.128	0.096	0.110	0.086	0.138	0.208					0.0108	0.3465	NA
		0.050	0.108	0.164	0.174								0.0428	0.9316	11.7
	0.104	0.114	0.168										0.0320	0.8639	3.0
	0.122	0.148	0.162										0.0200	0.9709	3.0
	0.088	0.124	0.118	0.136									0.0138	0.7612	4.0
	0.090	0.130	0.124	0.158									0.0198	0.8381	4.0
	0.074	0.076	0.046	0.086	0.076	0.116	0.120						0.0089	0.5504	NA
	0.090	0.110		0.098	0.118	0.120	0.140						0.0065	0.7319	NA
		0.180	0.202		0.182	0.212	0.282	0.294	0.302				0.0188	0.7895	26.6
	0.228	0.238	0.180		0.188	0.246	0.306	0.336	0.316				0.0151	0.5574	33.1
			0.118		0.020	0.084	0.120		0.306	0.242	0.272		0.0303	0.6573	16.5
		0.076			0.078	0.102		0.248	0.196	0.222			0.0225	0.7370	22.2
0.000															
	0.074				0.070	0.126	0.092	0.180	0.190				0.0146	0.6087	34.4
0.000				0.100			0.162	0.204	0.224				0.0248	0.9950	NA
	0.108		0.106	0.134		0.134	0.164						0.0088	0.7878	NA
		0.086		0.050	0.086	0.094	0.132	0.132					0.0108	0.5573	NA
		0.060	0.116	0.086	0.146	0.156							0.0222	0.7600	22.5
	0.076	0.058	0.074	0.076	0.138								0.0142	0.5280	35.2
	0.076	0.210	0.164	0.192									0.0302	0.4304	16.6
	0.118		0.158			0.154	0.236	0.194	0.196				0.0106	0.6217	NA
	0.122		0.100		0.076	0.090	0.216	0.212	0.198				0.0143	0.4306	35.0
	0.084		0.152		0.100		0.110	0.150	0.272	0.214	0.214		0.0141	0.5580	35.5
		0.106				0.078	0.112	0.188	0.156	0.172			0.0102	0.4505	NA
	0.070		0.108	0.116									0.0159	0.9714	31.5
													Average Years Until		20.1

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction												Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	0.09704	0.120283	0.136077	0.1308	0.129818	0.154333	0.167238	0.207294	0.211733	0.21175	0.235667		**0.0211**	**0.7384**
Std. Dev.	0	0.039022	0.053054	0.044951	0.041312	0.054493	0.071598	0.068119	0.064575	0.05989	0.044905	0.05943			
Ave + 1 Std. Dev.	0	0.136062	0.173337	0.181028	0.181028	0.184311	0.225931	0.235357	0.271869	0.271869	0.271869	0.295096			
Ave - 1 Std. Dev.	0	0.058018	0.067228	0.091125	0.091125	0.091125	0.091125	0.099119	0.142719	0.151844	0.166845	0.176237			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	25	23	26	20	22	18	21	17	15	8	6	0		
Terminal Threshold	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		


Increase in Permanent Deformation and the Threshold
Principal Arterials
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Depth of Permanent Deformation (inches) Per Tenth Mile
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
4
5
6
7
8
9
10
11
Years After Reconstruction
Average Slope = 0.0211
Average R² = 0.7384
Average Life = 23 Years
Minimum Life = 20 Years
Maximum Life = 26 Years

Increase in Permanent Deformation and the Threshold

Minor Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

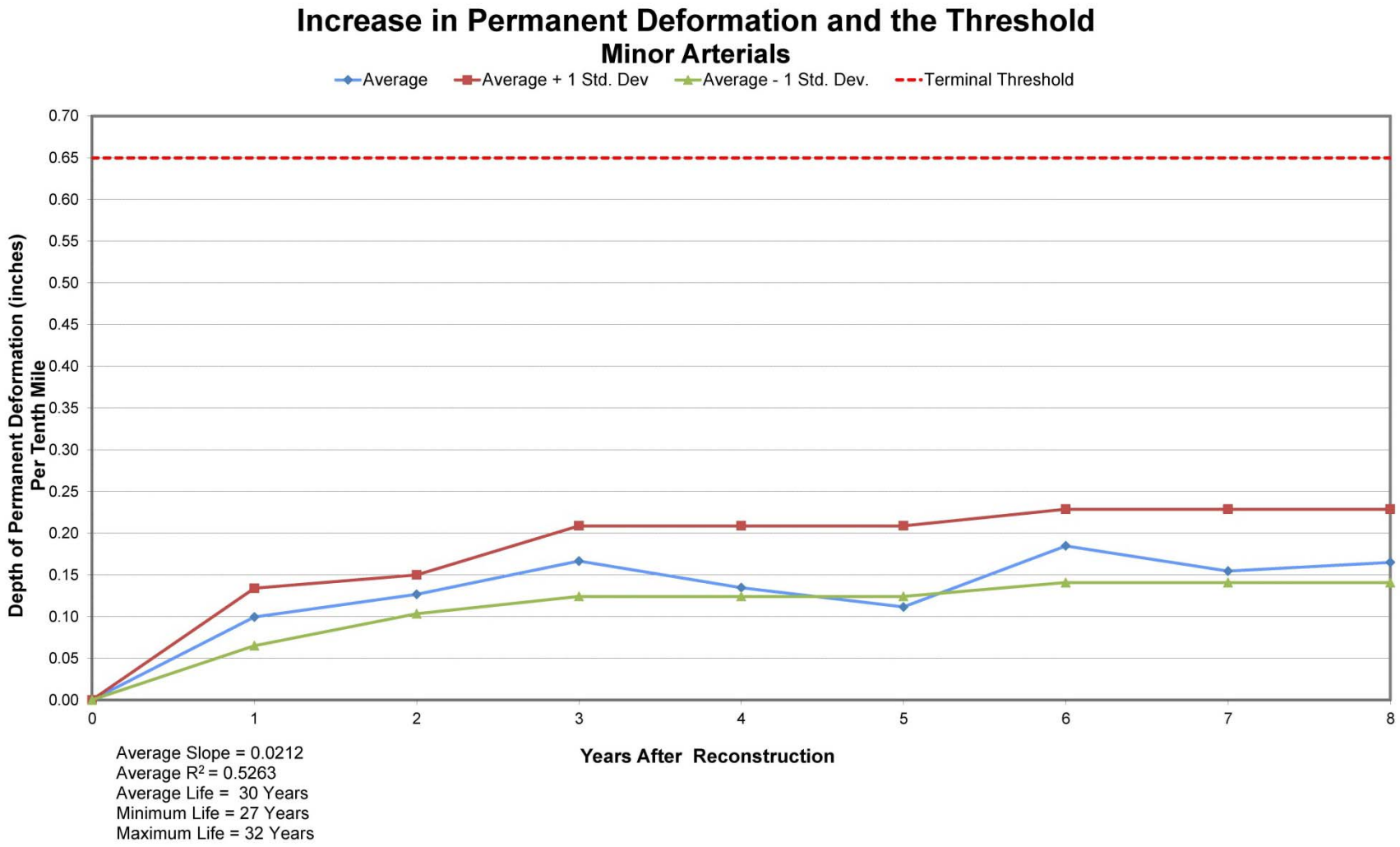
Permanent Deformation															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
0.000	0.094		0.128		0.100	0.142	0.194	0.200					0.0200	0.7993	32.4
	0.090	0.160	0.170	0.084	0.082		0.130	0.168					0.0033	0.0444	NA
	0.064	0.100	0.152		0.078	0.244							0.0235	0.4450	6.0
		0.126	0.176	0.238									0.0560	0.9962	4.0
0.000	0.180	0.128	0.222	0.156	0.092	0.140		0.142							
	0.090	0.144	0.198	0.162	0.174								0.0186	0.5246	34.9
	0.086	0.102	0.196	0.142	0.174								0.0216	0.5390	30.1
	0.088		0.090	0.090	0.112	0.200	0.154						0.0161	0.5799	NA
	0.104			0.070	0.080	0.198	0.140	0.150					0.0103	0.2819	NA
													Average Years Until Rehabilitation		21.5

Indicates the average year extrapolated from last correlatable data.

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.0995	0.1267	0.1665	0.1346	0.1115	0.1848	0.1545	0.1650					**0.0212**	**0.5263**
Std. Dev.	0.0000	0.0344	0.0234	0.0424	0.0587	0.0402	0.0440	0.0281	0.0257						
Ave + 1 Std. Dev.	0.0000	0.1339	0.1500	0.2089	0.2089	0.2089	0.2288	0.2288	0.2288						
Ave - 1 Std. Dev.	0.0000	0.0651	0.1033	0.1241	0.1241	0.1241	0.1408	0.1408	0.1408						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	8	6	8	7	8	5	4	4	0	0	0	0		
Terminal Threshold	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65		


Increase in Permanent Deformation and the Threshold
Minor Arterials
Average
Average + 1 Std. Dev
Average - 1 Std. Dev.
Terminal Threshold
Depth of Permanent Deformation (inches) Per Tenth Mile
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
4
5
6
7
8
Years After Reconstruction
Average Slope = 0.0212
Average R2 = 0.5263
Average Life = 30 Years
Minimum Life = 27 Years
Maximum Life = 32 Years

Increase in Permanent Deformation and the Threshold

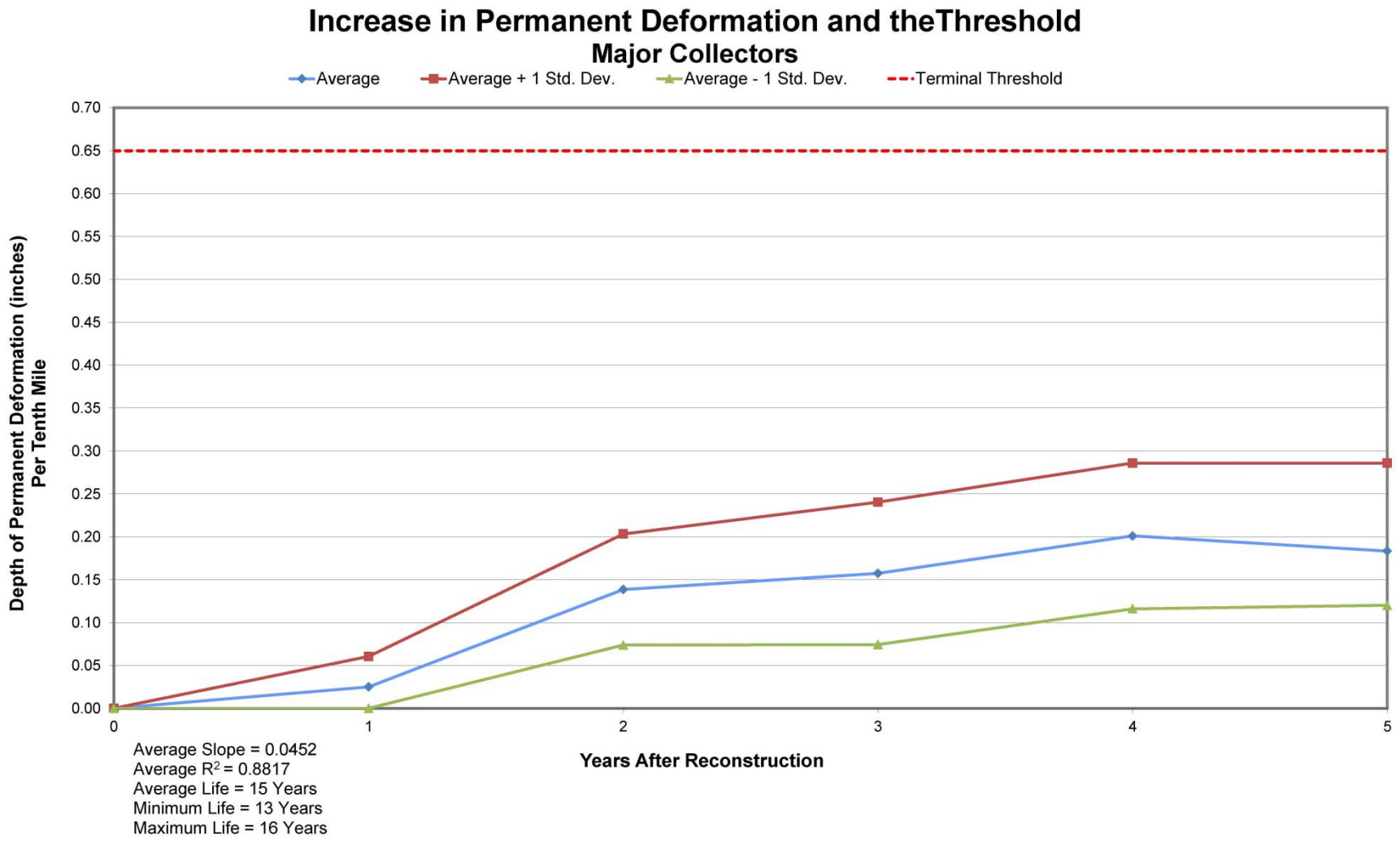
Major Collectors

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

Permanent Deformation															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
	0.050	0.058	0.076	0.098	0.118								0.0176	0.9778	36.9
0.000		0.188		0.282									0.0705	0.9643	8.1
	0.000	0.194	0.242	0.258	0.244								0.0552	0.6577	12.4
0.000		0.114	0.154	0.166	0.188								0.0373	0.9273	17.4
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		18.7

Explanation
Original data
Deleted data (anomaly)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.0250	0.1385	0.1573	0.2010	0.1833								**0.0452**	**0.8817**
Std. Dev.	0.0000	0.0354	0.0648	0.0831	0.0849	0.0631									
Ave + 1 Std. Dev.	0.0000	0.0604	0.2033	0.2404	0.2859	0.2859									
Ave - 1 Std. Dev.	0.0000	0.0000	0.0737	0.0743	0.1161	0.1202									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	2	4	3	4	3	0	0	0	0	0	0	0		
Terminal Threshold	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65		


Increase in Permanent Deformation and theThreshold
Major Collectors
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Depth of Permanent Deformation (inches) Per Tenth Mile
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
4
5
Years After Reconstruction
Average Slope = 0.0452
Average R2 = 0.8817
Average Life = 15 Years
Minimum Life = 13 Years
Maximum Life = 16 Years

Increase in Permanent Deformation and the Threshold

Statewide

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

Permanent Deformation

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.094		0.128		0.100	0.142	0.194	0.200	0.234				0.0170	0.7892	29.5
	0.084		0.086		0.110		0.108		0.152	0.148	0.182		0.0093	0.8861	NA
		0.083		0.126	0.148	0.152							0.0183	0.9586	27.4
	0.050	0.058	0.076	0.098	0.118								0.0176	0.9778	36.9
	0.128			0.158	0.094		0.204	0.226	0.202				0.0127	0.5361	39.4
	0.056	0.090	0.166	0.168	0.226								0.0418	0.9493	12.0
0.000		0.188		0.282									0.0705	0.9643	8.0
	0.034	0.082	0.114	0.194	0.212								0.0468	0.9710	10.7
	0.056	0.104	0.118	0.132	0.148								0.0212	0.9114	23.6
							0.120	0.138	0.156	0.216	0.248		0.0334	0.9483	15.0
							0.146	0.140	0.178	0.294	0.328		0.0518	0.8729	9.7
				0.160	0.078	0.110	0.132	0.186	0.170				0.0113	0.2725	NA
	0.140	0.202	0.208	0.104	0.136	0.298	0.270	0.296					0.0206	0.4437	24.2
	0.150	0.198	0.254		0.134	0.280	0.256	0.268					0.0133	0.3481	37.6
	0.094	0.216	0.148	0.180	0.220	0.250	0.142	0.164	0.262	0.248	0.338		0.0144	0.4829	34.8
	0.100	0.100	0.112	0.166	0.072	0.068	0.112	0.170	0.156				0.0056	0.1597	NA
		0.248	0.152	0.208	0.082	0.090	0.160	0.186	0.194						
	0.060	0.142	0.128	0.096	0.110	0.086	0.138	0.208					0.0108	0.3465	NA
	0.052		0.056	0.174	0.214								0.0427	0.7833	9.0
	0.052		0.084	0.156	0.192								0.0360	0.9148	11.1
		0.05	0.108	0.164	0.174								0.0428	0.9316	11.7
	0.104	0.114	0.168	0.076	0.120	0.188	0.158	0.172					0.0095	0.3510	NA
	0.122	0.148	0.162	0.080	0.100	0.178	0.170	0.180					0.0070	0.2037	NA
	0.088	0.124	0.118	0.136	0.080	0.124	0.124	0.166	0.162				0.0070	0.4486	NA
	0.090	0.130	0.124	0.158	0.106	0.082	0.172	0.198	0.216				0.0121	0.4953	NA
	0.074	0.076	0.046	0.086	0.076	0.116	0.120						0.0089	0.5504	NA
	0.090	0.110		0.098	0.118	0.120	0.140						0.0065	0.7319	NA
	0.090	0.160	0.170	0.084	0.082		0.130	0.168					0.0033	0.0444	NA
	0.064	0.100	0.152		0.078	0.244							0.0235	0.4450	6.0
		0.126	0.176	0.238									0.0560	0.9962	4.0
	0.180	0.128	0.222	0.156	0.092	0.140		0.142	0.188						
		0.180	0.202	0.270	0.182	0.212	0.282	0.294	0.302				0.0164	0.6090	NA
			0.228	0.238	0.180	0.312	0.188	0.246	0.306	0.336	0.316		0.0139	0.4272	36.1
	0.000	0.118	0.000		0.084	0.120	0.000	0.306	0.242	0.272					NA
		0.076		0.244	0.078	0.102		0.248	0.196	0.222			0.0156	0.3251	32.1
	0.298		0.240		0.106	0.144	0.212	0.194	0.198						
	0.074				0.070	0.126	0.092	0.180	0.190				0.0146	0.6087	34.4
0.118				0.100			0.162	0.204	0.224				0.0124	0.7130	NA
	0.108		0.106	0.134		0.134	0.164						0.0088	0.7878	NA
	0.086		0.114	0.078	0.088		0.134	0.130					0.0065	0.4873	NA
0.088	0.200	0.200											0.0560	0.7500	2.0
	0.140	0.182	0.190	0.196									0.0176	0.8050	4.0
	0.180	0.210	0.200	0.288									0.0314	0.7333	4.0
		0.194	0.242	0.258	0.244								0.0166	0.5891	5.0
0.000		0.114	0.154	0.166	0.188		0.130	0.214	0.204	0.202			0.0158	0.6466	31.6
0.000	0.900	0.144	0.198	0.162	0.174										
	0.086	0.102	0.196	0.142	0.174								0.0216	0.5390	23.1
		0.086		0.050	0.086	0.094	0.132	0.132					0.0108	0.5573	NA
		0.060	0.116	0.086	0.146	0.156							0.0222	0.7600	22.5
	0.076	0.058	0.074	0.076	0.138								0.0142	0.5280	35.2
	0.088		0.090	0.090	0.112	0.200	0.154						0.0161	0.5799	31.1
	0.076	0.210	0.164	0.192									0.0302	0.4304	16.6
	0.118		0.158		0.116	0.154	0.236	0.194	0.196				0.0112	0.5166	NA
	0.122		0.100		0.076	0.090	0.216	0.212	0.198				0.0143	0.4306	35.0
	0.084		0.152		0.100		0.110	0.150	0.272	0.214	0.214		0.0141	0.5580	35.5
		0.106		0.216		0.078	0.112	0.188	0.156	0.172			0.0042	0.0569	NA
	0.070		0.108	0.116									0.0159	0.9714	31.5
	0.104			0.070	0.080	0.198	0.140	0.150					0.0103	0.2819	NA

Indicates the average year extrapolated from last correlatable data.

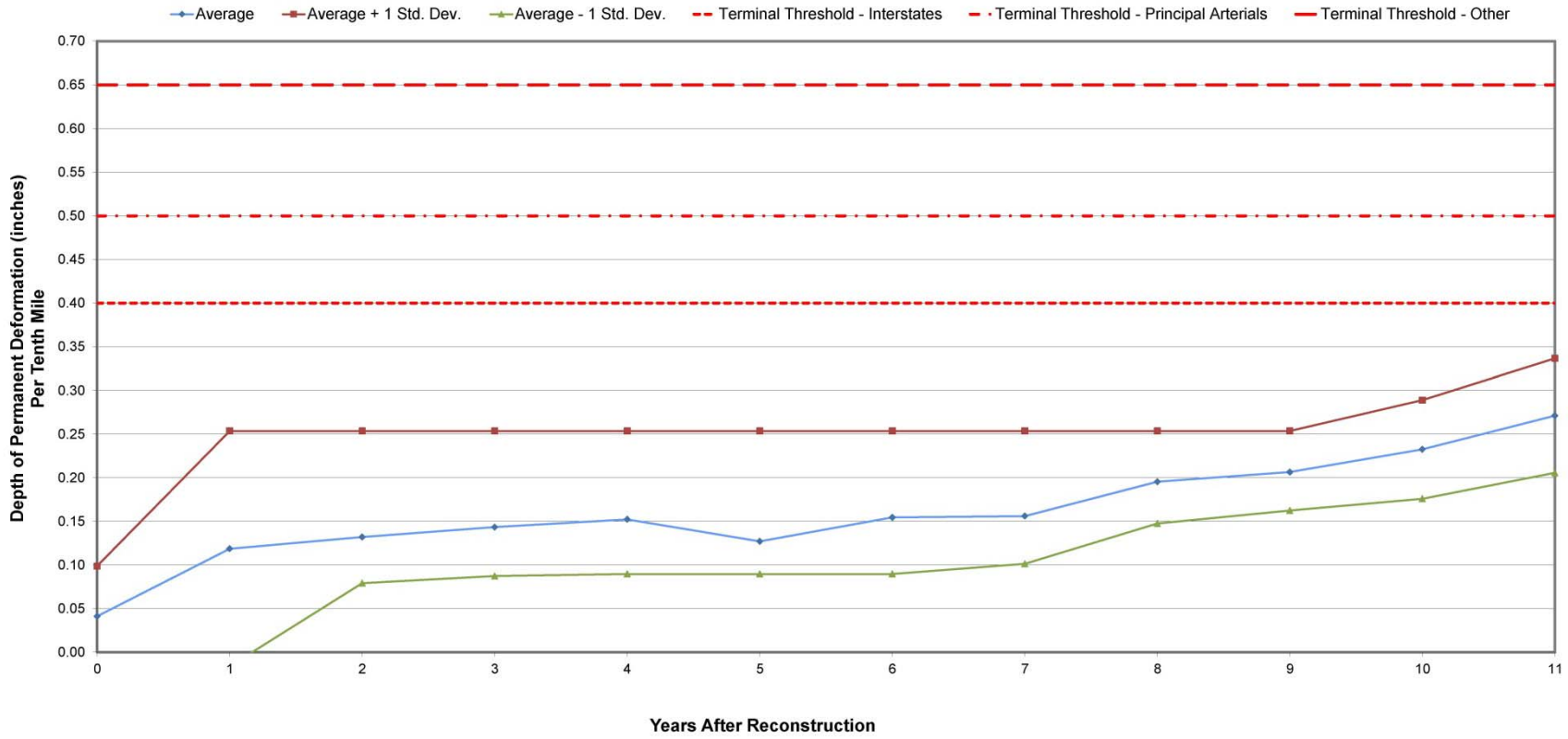
Average Years Until Rhabilitation **21.5**

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0412	0.1186	0.1320	0.1434	0.1522	0.1270	0.1545	0.1560	0.1953	0.2064	0.2324	0.2710		**0.0204**	**0.6114**
Std. Dev.	0.0574	0.1350	0.0529	0.0562	0.0626	0.0489	0.0668	0.0547	0.0477	0.0441	0.0565	0.0655			
Ave + 1 Std. Dev.	0.0986	0.2536	0.2536	0.2536	0.2536	0.2536	0.2536	0.2536	0.2536	0.2536	0.2889	0.3365			
Ave - 1 Std. Dev.	-0.0162	-0.0162	0.0791	0.0872	0.0897	0.0897	0.0897	0.1013	0.1476	0.1623	0.1759	0.2055			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	5	41	38	44	45	46	31	35	32	24	10	6	0		
Terminal Thresholde - Interstates	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
Terminal Threshold - Principal Arteri	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Terminal Threshold - Others	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65		

Increase in Permanent Deformation and theThreshold
Statewide Average



Average Slope = 0.0204
Average R^2 = 0.6114
Average Life for Interstates = 17 Years
Minimum Life for Interstates = 14 Year
Maximum Life for Interstates = 20 Years

Average Life for PAs = 22 Years
Minimum Life for PAs = 19 Years
Maximum Life for PAs = 25 Years

Average Life for Others = 29 Years
Minimum Life for Others = 26 Years
Maximium Life for Others = 32 Years

Note: A permanent deformation threshold of 0.40 inches was used for interstates, 0.5 inches for principal areterials (PAs), and 0.65 for all other roadways.

Increase in Fatigue Cracking and the Threshold

Interstates

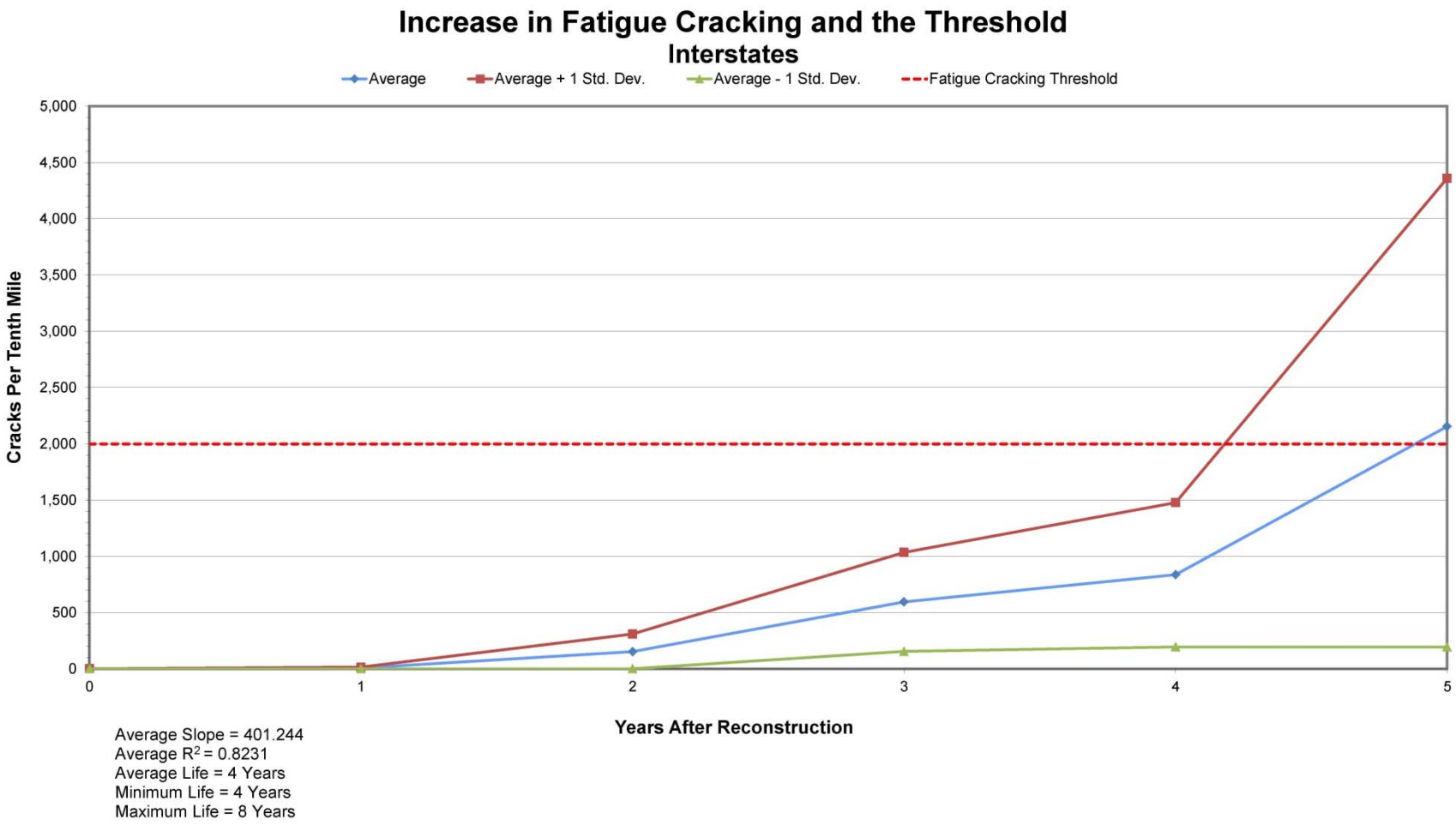
Highway	Starting MM	Ending MM	Length (miles)	Direction
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2

Fatigue															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
0.0	6.8	383.6	720.2		5514.8								1076.5351	0.7692	9.0
	2.0	103.8	670.0		1454.4								383.8343	0.9682	5.2
0.0	0.0	0.0	77.2		73.2	218.2	176.8	292.4					35.5400	0.8617	NA
	0.0	4.0	50.8	142.4	76.4	345.8	264.8	188.2					40.9571	0.6401	NA
	9.0	120.8	1114.0	956.0	1741.6	1770.6	1523.2	1957.6					278.6619	0.8306	8.1
	19.2	296.2	932.8	1408.6	4070.4	3598.8	4286.8	4045.2					699.9381	0.8687	3.4
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		6.4

Explanation

- Original data
- Deleted data (anomalie)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	6.1667	151.4000	594.1667	835.6667	2155.1333	1483.3500	1562.9000	1620.8500					**419.2444**	**0.8231**
Std. Dev.	0.0000	7.3717	156.6746	440.2354	641.6196	2203.3258	1576.0992	1917.2501	1808.1426						
Ave + 1 Std. Dev.	0.0000	13.5384	308.0746	1034.4021	1477.2863	4358.4591	4358.4591	4358.4591	4358.4591						
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	153.9312	194.0471	194.0471	194.0471	194.0471	194.0471						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	6	6	6	3	6	4	4	4	0	0	0	0		
Terminal Threshold	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		



Average Slope = 401.244
Average R^2 = 0.8231
Average Life = 4 Years
Minimum Life = 4 Years
Maximum Life = 8 Years

Increase in Fatigue Cracking and the Threshold

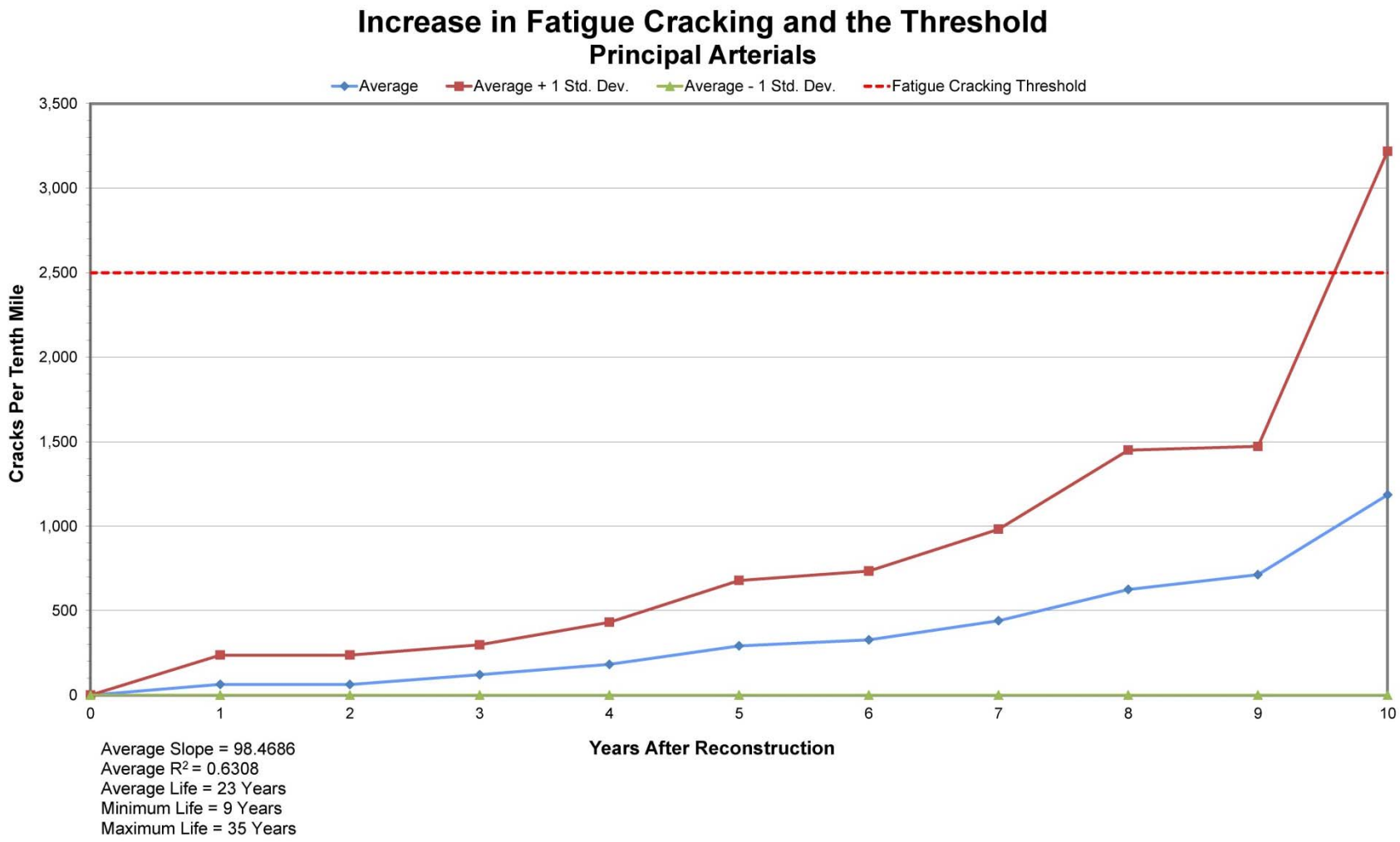
Principal Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

Fatigue															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.0		2.4				0.0		7.2	15.0	45.0		2.9864	0.4805	NA
		2.0		40.4	9.6	23.2							3.7943	0.1477	NA
	79.0		55.8	88.6	82.8	85.8	165.2	147.4	226.8				18.0476	0.6931	NA
	0.0	0.0	0.0	2.0	10.4								2.2800	0.6386	NA
	175.2	127.0	331.6	457.8	730.2								144.0800	0.8805	17.4
	266.2	175.4	578.4										156.1000	0.5453	3.0
						199.2	368.4	502.8	865.6				213.3600	0.9466	9.0
							393.8	418.2	771.0		761.0		103.1086	0.7159	24.2
				32.0	7.6	30.0	174.8	234.0					57.1200	0.7858	9.0
	36.6	94.2	121.6	138.0	761.4	1234.0		2796.0					380.2189	0.8223	6.6
	16.2	50.0	463.4		893.8		1903.2						315.6052	0.9528	7.0
	0.0	0.0	4.0	48.0	86.6	504.0	112.4	408.6	1970.2		2150.6		211.1727	0.6692	11.8
	0.0	0.0	54.8	59.2		4.2	26.4	39.6	282.2				18.9300	0.3511	NA
	0.0		17.8	910.6	602.0	571.6	430.0	1684.4					176.1746	0.5407	14.2
0.0		0.0		6.0	79.6								12.6508	0.5199	NA
	0.8		0.0	89.2	129.4	114.4	201.2	312.4					42.5352	0.8606	NA
	1.6	9.2	0.0	3.0	48.8	34.2	34.2	54.6					7.6714	0.7078	NA
0.0	6.0	6.6	29.6	74.0	73.0	32.8	120.6	70.2	131.4				13.3976	0.7419	NA
0.0	0.0	13.8	32.4	64.4	80.4	87.8	205.2	175.2	192.0				24.8097	0.8945	NA
	14.2	39.2	13.6	23.2	43.0	37.4	60.0						5.8286	0.5554	NA
	26.4	40.2	73.0	166.0	131.4	41.6	133.4						13.6500	0.2822	NA
		280.8	354.8	329.4	487.6	571.8	988.4	774.2	838.4				95.9690	0.8011	26.1
	204.2	382.4	253.4	567.0	334.2	826.4	946.4						114.1214	0.7295	7.0
			77.4		1297.0	414.0	1309.4		2338.2	3532.6			448.3840	0.8259	10.0
		0.0		733.2		780.2		420.4	1830.0				171.2549	0.5232	9.0
	2.6		8.4		134.0	202.6	319.4	944.2					107.2588	0.6309	8.0
	10.0		8.6			177.0	95.2	678.4	419.6				65.4493	0.5705	38.2
	0.0		0.0	394.0				409.8	767.0				84.8565	0.7925	29.5
	21.0		208.6	499.6	263.0	379.0	818.4						106.0600	0.6960	23.6
		0.0		1.6	4.8	12.2	114.0	156.4					26.2057	0.6758	NA
	0.0	0.0	0.0	3.0	2.6	0.2							0.3371	0.1951	NA
	5.2	45.0	0.0	18.0	0.0										
	6.2	5.6	0.0	3.0											
	879.8		603.8		1293.0	1479.2	1801.4	2986.8					273.9882	0.7226	8.0
	12.6		7.4		6.8		32.2	118.4	27.0				7.5832	0.3008	NA
	0.0		137.8		247.6		681.0	413.6					79.9756	0.7573	8.0
		0.0		14.8			17.2	14.0	22.0	8.8			1.3859	0.3143	NA
	5.6	157.6	167.2	130.8									38.5200	0.4427	NA
													Average Years Until Rehabilitation		14.2

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	63.1929	62.1304	120.1933	181.3630	290.3926	326.7833	440.4538	625.4364	712.5733	1185.4667	985.5333		**98.4686**	**0.6308**
Std. Dev.	0.0000	173.7467	101.1145	176.7378	249.7569	388.3072	406.9756	541.6965	824.7505	759.6427	2032.6795	1070.6070			
Ave + 1 Std. Dev.	0.0000	236.9396	236.9396	296.9311	431.1198	678.6998	733.7589	982.1504	1450.1868	1472.2160	3218.1461	3218.1461			
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	3	28	23	30	27	27	24	26	22	15	3	3	0		
Terminal Threshold	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500		


Increase in Fatigue Cracking and the Threshold
Principal Arterials
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Fatigue Cracking Threshold
Cracks Per Tenth Mile
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
1
2
3
4
5
6
7
8
9
10
Years After Reconstruction
Average Slope = 98.4686
Average R² = 0.6308
Average Life = 23 Years
Minimum Life = 9 Years
Maximum Life = 35 Years

Increase in Fatigue Cracking and the Threshold

Minor Arterials

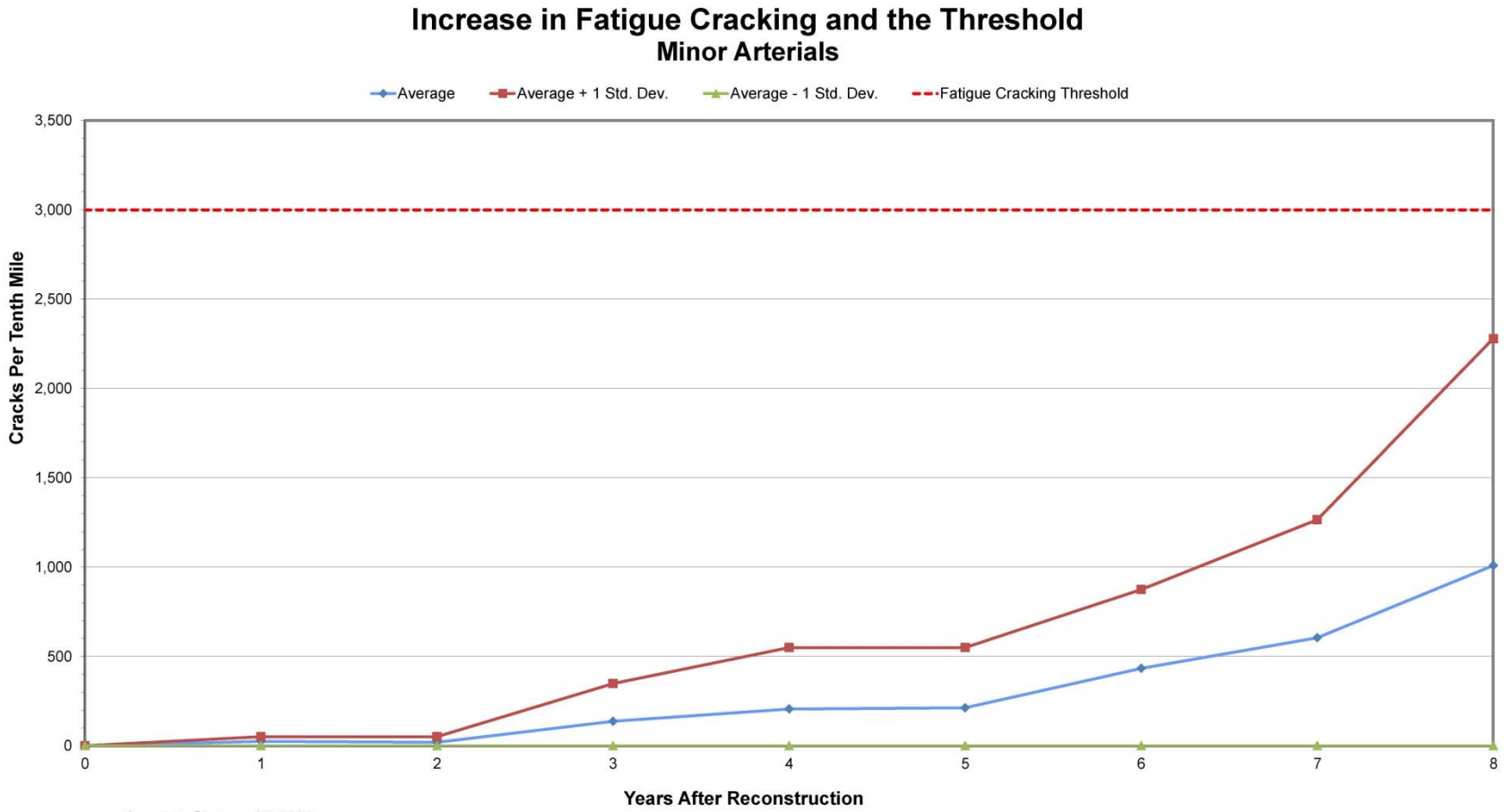
Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

Fatigue															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	56.6		157.8		117.0	346.2	701.8	609.0					89.2588	0.7399	34.8
0.0	0.8	6.6	120.2	76.0	271.6	599.2	630.6						97.1071	0.8127	7.0
	6.2	4.4	13.6	12.2	61.0	267.8	137.2	76.8					23.4476	0.3939	NA
		24.4	43.4	141.0	116.6	255.8	418.2						73.7657	0.8671	7.0
		6.2	640.2	1047.2	992.8	1349.0	2002.8	2883.2					416.3571	0.9218	8.0
	15.2	61.0	94.6	69.8	34.4								4.7200	0.0581	NA
0.0	5.6	8.0	20.8	42.6	51.8								10.9371	0.9258	NA
	19.6		0.0	173.0	39.0	0.0	50.0						1.5571	0.0027	NA
	64.0			84.0	223.0	215.4	290.8	466.2					52.9200	0.7966	NA
													Average Years Until Rehabilitation		14.2

Indicates the average year extrapolated from last correlatable data.

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	24.0000	18.4333	136.3250	205.7250	211.9111	433.3429	604.4857	1008.8000					**85.5634**	**0.6132**
Std. Dev.	0.0000	25.6684	22.1043	211.1124	343.8279	304.4223	441.1616	661.3555	1269.6790						
Ave + 1 Std. Dev.	0.0000	49.6684	49.6684	347.4374	549.5529	549.5529	874.5045	1265.8412	2278.4790						
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	7	6	8	8	9	7	7	4	0	0	0	0		
Terminal Threshold	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000		



Average Slope = 85.5634
Average R^2 = 0.6132
Average Life = 31 Years
Minimum Life = 16 Years
Maximum Life = 35 Years

Increase in Fatigue Cracking and the Threshold

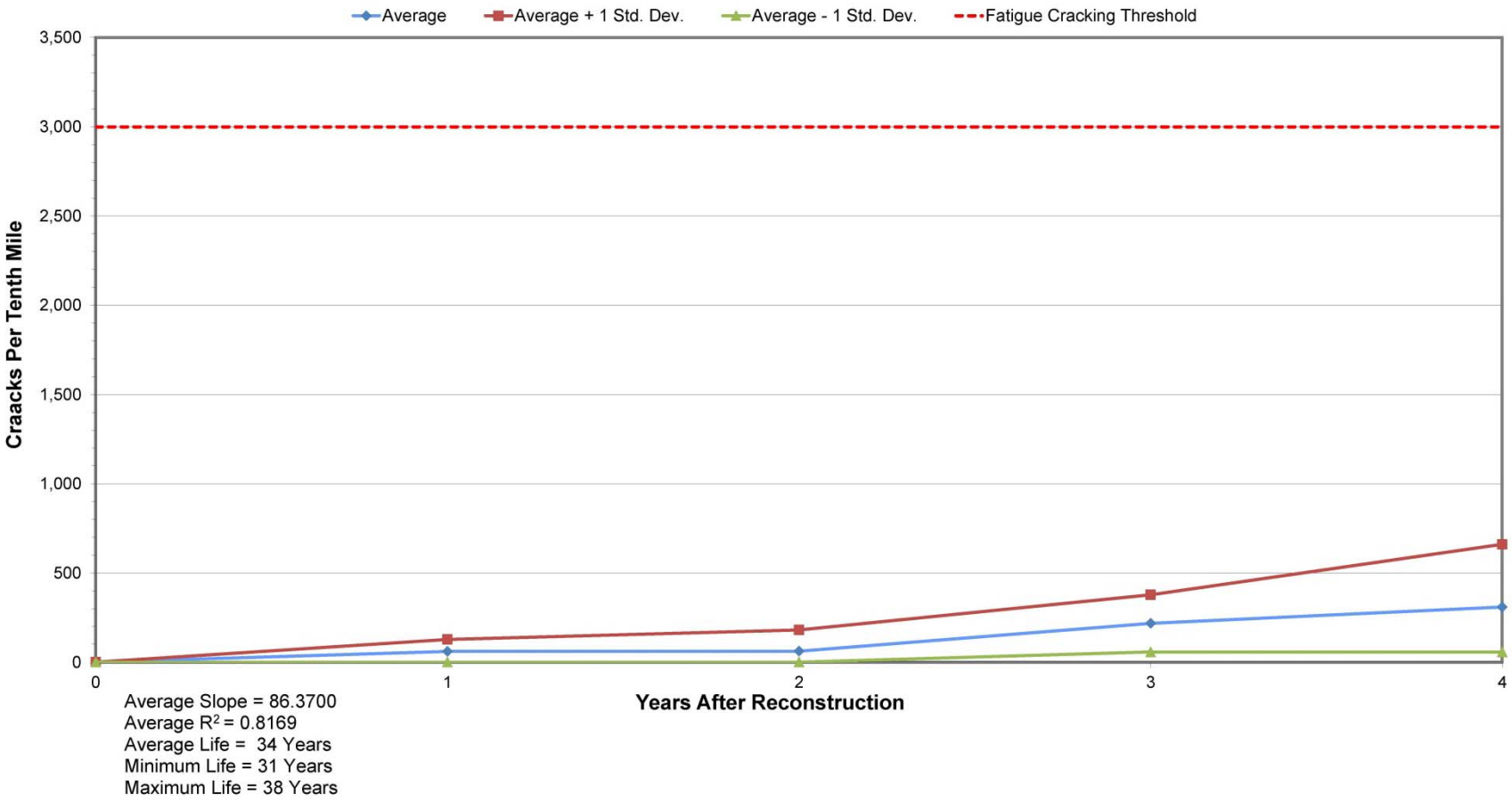
Major Collectors

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

Fatigue															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	
	132.8	240.0	401.2	819.2									222.0400	0.9039	4.0
0.0		6.6		53.2									13.3000	0.8414	NA
0.0	1.4	0.0	105.8	103.8									31.2000	0.7450	NA
	45.8	0.0	145.0	260.6									78.9400	0.7771	34.7
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		19.4

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction												Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	60.0000	61.6500	217.3333	309.2000									**86.3700**	**0.8169**
Std. Dev.	0.0000	66.8410	118.9407	160.4350	351.2773										
Ave + 1 Std. Dev.	0.0000	126.8410	180.5907	377.7683	660.4773										
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	56.8984	56.8984										
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	3	4	3	4	0	0	0	0	0	0	0	0		
Terminal Threshold	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000		


Increase in Fatigue Cracking and the Threshold
Major Collectors
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Fatigue Cracking Threshold
Craacks Per Tenth Mile
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
1
2
3
4
Years After Reconstruction
Average Slope = 86.3700
Average R² = 0.8169
Average Life = 34 Years
Minimum Life = 31 Years
Maximum Life = 38 Years

Increase in Fatigue Cracking and the Threshold
Statewide

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

Fatigue															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	56.6		157.8		117.0	346.2	701.8	609.0	1135.8				121.4048	0.7638	24.7
	0.0		2.4				0.0		7.2	15.0	45.0		2.9864	0.4805	NA
		2.0		40.4	9.6	23.2							3.7943	0.1477	NA
	132.8	240.0	401.2	819.2									222.0400	0.9039	5.0
	79.0		55.8	88.6	82.8	85.8	165.2	147.4	226.8				18.0476	0.6931	NA
	0.0	0.0	0.0	2.0	10.4								2.2800	0.6386	NA
		6.6		53.2		168.0	239.8						46.8814	0.9552	7.0
	175.2	127.0	331.6	457.8	730.2								144.0800	0.8805	17.4
	266.2	175.4	578.4										156.1000	0.5453	3.0
						199.2	368.4	502.8	865.6				213.3600	0.9466	9.0
							393.8	418.2	771.0		761.0		103.1086	0.7159	24.2
				32.0	7.6	30.0	174.8	234.0					57.1200	0.7858	10.0
	36.6	94.2	121.6	138.0	761.4	1234.0		2796.0					380.2189	0.8223	6.6
	16.2	50.0	463.4		893.8		1903.2						315.6052	0.9528	7.0
	0.0	0.0	4.0	48.0	86.6	504.0	112.4	408.6	1970.2		2150.6		211.1727	0.6692	11.8
	0.0	0.0	54.8	59.2		4.2	26.4	39.6	282.2				18.9300	0.3511	NA
	0.0		17.8	910.6	602.0	571.6	430.0	1684.4					176.1746	0.5407	14.2
	6.8	383.6	720.2		5514.8								1404.4286	0.8584	9.0
	2.0	103.8	670.0		1454.4								383.8343	0.9682	6.4
0.0		0.0		6.0	79.6								12.6508	0.5199	NA
	0.8		0.0	89.2	129.4	114.4	201.2	312.4					42.5352	0.8606	NA
	1.6	9.2	0.0	3.0	48.8	34.2	34.2	54.6					7.6714	0.7078	NA
0.0	6.0	6.6	29.6	74.0	73.0	32.8	120.6	70.2	131.4				13.3976	0.7419	NA
0.0	0.0	13.8	32.4	64.4	80.4	87.8	205.2	175.2	192.0				24.8097	0.8945	NA
	14.2	39.2	13.6	23.2	43.0	37.4	60.0						5.8286	0.5554	NA
	26.4	40.2	73.0	166.0	131.4	41.6	133.4						13.6500	0.2822	NA
	0.8	6.6	120.2	76.0	271.6	599.2	630.6						115.2143	0.8536	7.0
	6.2	4.4	13.6	12.2	61.0	267.8	137.2	76.8					23.4476	0.3939	NA
		24.4	43.4	141.0	116.6	255.8	418.2						73.7657	0.8671	7.0
		6.2	640.2	1047.2	992.8	1349.0	2002.8	2883.2					416.3571	0.9218	8.0
		280.8	354.8	329.4	487.6	571.8	988.4						124.2057	0.7893	7.0
	204.2	382.4	253.4	567.0	334.2	826.4	946.4	459.0	580.8				56.3600	0.3753	NA
			77.4		1297.0	414.0	1309.4		2338.2	3532.6			448.3840	0.8259	10.0
		0.0		733.2		780.2		420.4	1830.0				171.2549	0.5232	9.0
	2.6		8.4		134.0	202.6	319.4	944.2					107.2588	0.6309	8.0
	10.0		8.6			177.0	95.2	678.4	419.6				65.4493	0.5705	38.2
	0.0		0.0	394.0				409.8	767.0				84.8565	0.7925	29.5
	21.0		208.6	499.6	263.0	379.0	818.4						106.0600	0.6960	23.6
	0.0	0.0	77.2		73.2	218.2	176.8	292.4					39.6425	0.8693	NA
	0.0	4.0	50.8	142.4	76.4	345.8	264.8	188.2					40.9571	0.6401	NA
	9.0	120.8	1114.0	956.0	1741.6	1770.6	1523.2	1957.6	2583.8				290.7100	0.8809	6.9
	19.2	296.2	932.8	1408.6	4070.4	3598.8	4286.8	4045.2	3697.4				580.9667	0.7991	3.4
	1.4	0.0	105.8	103.8	86.4	166.4	157.2	293.6	213.8	590.0			48.3224	0.7227	NA
	45.8		145.0	260.6		358.6	635.0	774.2					102.9837	0.9203	8.0
	15.2	61.0	94.6	69.8	34.4								4.7200	0.0581	NA
	5.6	8.0	20.8	42.6	51.8								12.7000	0.9443	NA
		0.0		1.6	4.8	12.2	114.0	156.4					26.2057	0.6758	NA
	0.0	0.0	0.0	3.0	2.6	0.2							0.3371	0.1951	NA
	5.2	45.0	0.0	18.0	0.0										
	19.6		0.0	173.0	39.0	0.0	50.0						1.5571	0.0027	NA
	6.2	5.6	0.0	3.0											
	879.8		603.8		1293.0	1479.2	1801.4	2986.8					273.9882	0.7226	8.0
	12.6		7.4		6.8		32.2	118.4	27.0				7.5832	0.3008	NA
	0.0		137.8		247.6		681.0	413.6					79.9756	0.7573	31.3
		0.0		14.8			17.2	14.0	22.0	8.8			1.3859	0.3143	NA
	5.6	157.6	167.2	130.8									38.5200	0.4427	NA
	64.0			84.0	223.0	215.4	290.8	466.2					52.9200	0.7966	NA

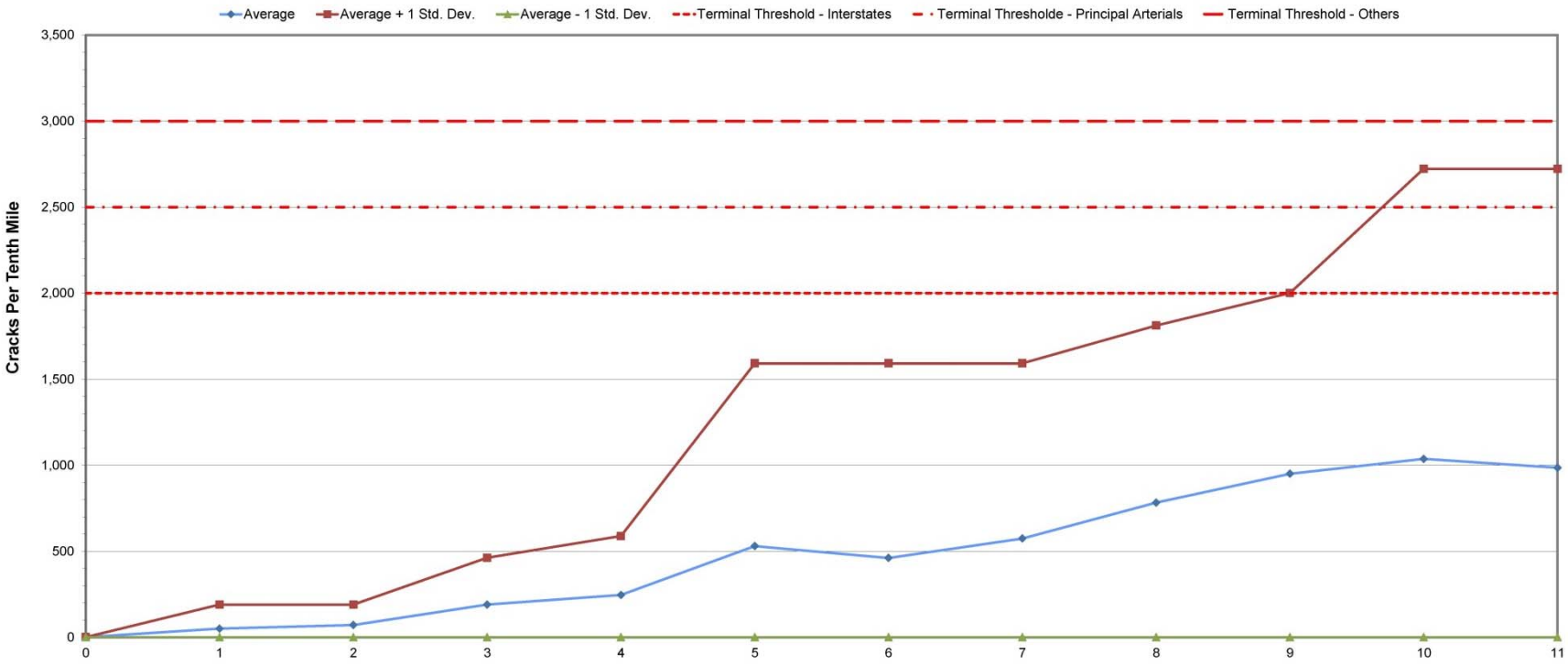
Indicates the average year extrapolated from last correlatable data.

Average Years Until Rehabilitation **12.4**

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	48.9636	70.9105	189.6468	244.9143	529.4186	460.5947	574.1700	782.2125	950.6211	1036.6000	985.5333		**136.3309**	**0.6630**
Std. Dev.	0.0000	140.5654	109.6717	271.4663	343.1466	1062.7772	682.4258	811.1214	1029.1154	1049.9269	1686.1699	1070.6070			
Ave + 1 Std. Dev.	0.0000	189.5290	189.5290	461.1131	588.0608	1592.1958	1592.1958	1592.1958	1811.3279	2000.5480	2722.7699	2722.7699			
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	3	44	38	47	42	43	38	40	32	19	4	3	0		
Terminal Threshold - Interstates	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
Terminal Threshold - Principal Arterials	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500		
Terminal Threshold - Others	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000		

Increase in Fatigue Cracking and the Threshold
Statewide



Average Slope = 136.3309
Average R2 = 0.6630
Average Life for Interstates = 18 Years
Minimum Life for Interstates = 5 Years
Maximum Life for Interstates = 25 Years

Average Life for PAs = 22 Years
Minimum Life for PAs = 9 Years
Maximum Life for PAs = 29 Years

Average Life for Others = 25 Years
Average Life for Others = 13 Years
Maximum Life for Others = 33 Years

Note: A terminal threshold for fatigue cracking of 2,0000 feet per mile was was used for interstates, 2,500 feet per mile for Principal Arterials (PAs), and 3,000 feet per mile for all other roadways.

Increase in Transverse Cracking and the Threshold

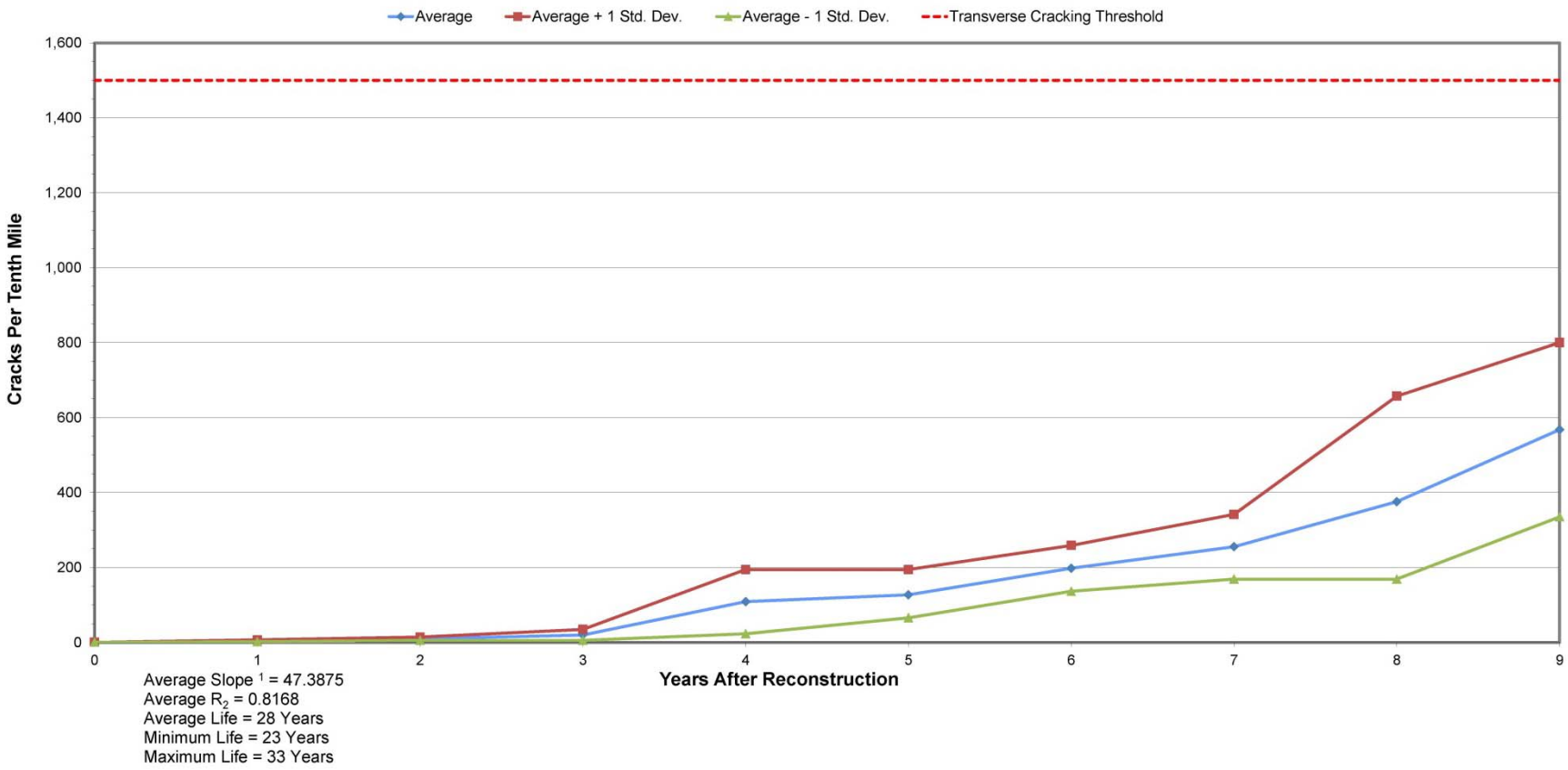
Interstates

Highway	Roadway Classification	Starting MM	Ending MM	Length (miles)	Direction
025A		79.6	85.5	5.9	1
025A		79.6	85.5	5.9	2
070A		5.0	11.6	6.6	1
070A		5.0	11.6	6.6	2
070A		22.0	37.0	15.0	1
070A		22.0	37.0	15.0	2

Transverse Cracking															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.0	14.4	7.2	45.6	148.8								32.8800	0.7137	9.0000
0.0	4.8	2.4	2.4	146.4	206.4								41.6229	0.7188	36.0000
	4.8	9.6	19.2	33.6	177.6	235.2	278.4	285.6					48.8286	0.8997	30.7000
	2.4	7.2	16.8	21.6	81.6	129.6	136.8	148.8					24.6571	0.9114	NA
	4.8	9.6	43.2	223.2	100.8	261.6	343.2	691.2	732.0				93.2000	0.8452	16.1000
0.0	7.2	14.4	28.8	180.0	45.6	163.2	261.6		403.2				43.1265	0.8120	31.1000
	Indicates the average year extrapolated from last correlatable data.											Average Years Until Rehabilitation			17.5

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	4.0000	9.6000	19.6000	108.4000	126.8000	197.4000	255.0000	375.2000	567.6000				**47.3858**	**0.8168**
Std. Dev.	0.0000	2.4787	4.5537	14.8270	85.8169	61.1773	61.4192	86.2972	282.0825	232.4967					
Ave + 1 Std. Dev.	0.0000	6.4787	14.1537	34.4270	194.2169	194.2169	258.8192	341.2972	657.2825	800.0967					
Ave - 1 Std. Dev.	0.0000	1.5213	5.0463	5.0463	22.5831	65.6227	135.9808	168.7028	168.7028	335.1033					
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	6	6	6	6	6	4	4	3	2	0	0	0		
Terminal Threshold	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		


Increase in Transverse Cracking and the Threshold
Interstates
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Transverse Cracking Threshold
Cracks Per Tenth Mile
1,600
1,400
1,200
1,000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
9
Years After Reconstruction
Average Slope [1] = 47.3875
Average R_2 = 0.8168
Average Life = 28 Years
Minimum Life = 23 Years
Maximum Life = 33 Years

Increase in Transverse Cracking and the Threshold

Principal Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

Transverse Cracking

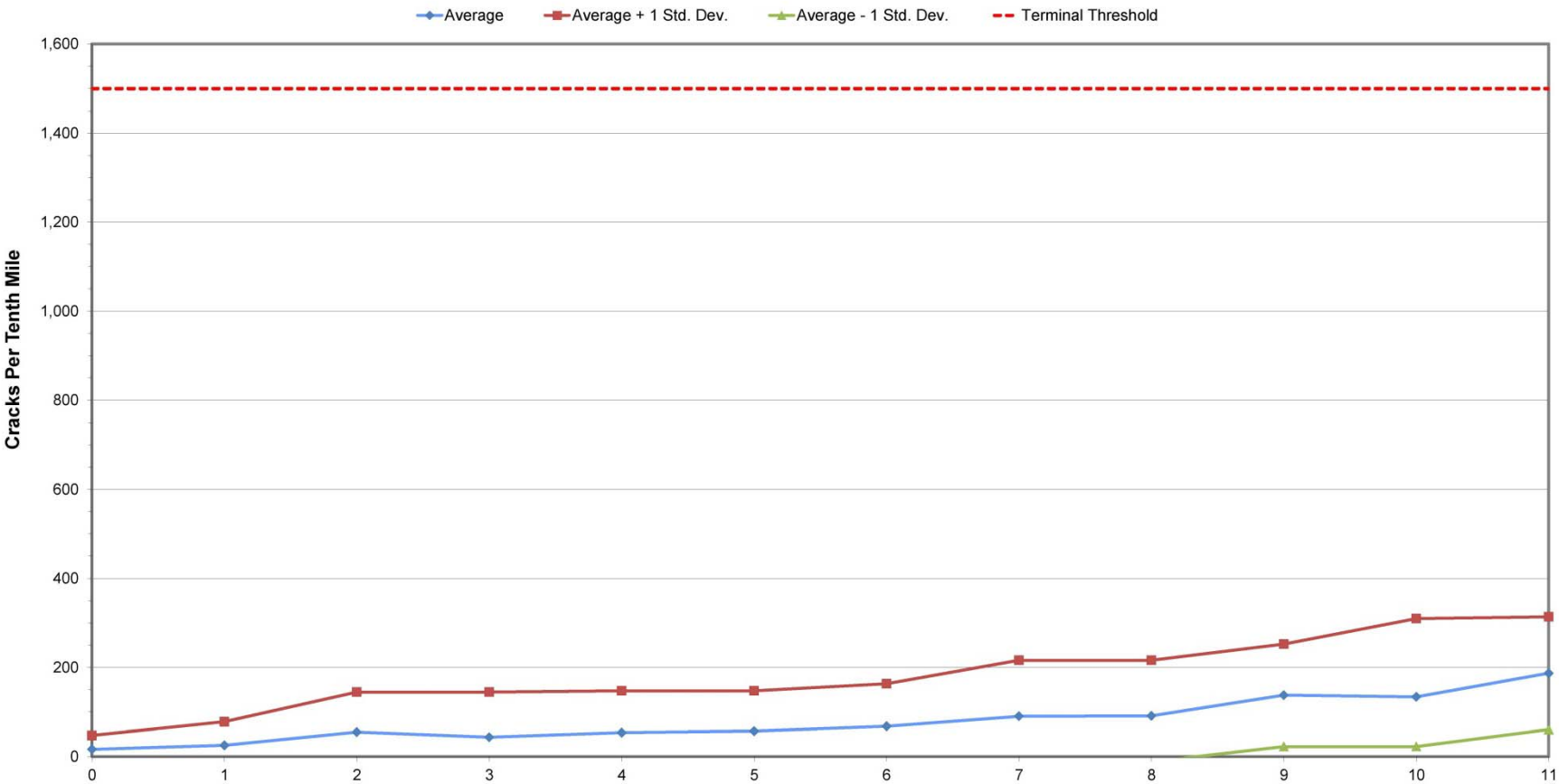
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	2.4		4.8		2.4		2.4		2.4	16.8	55.2		3.2805	0.3902	NA
3.0		3.0		4.8		12.0							1.4400	0.7529	5.0
	38.4		45.6	62.4	57.6	55.2	64.8	204.0	189.6				19.6271	0.6157	NA
	0.0	0.0	0.0	0.0	12.0								2.4000	0.5000	NA
7.2	19.2	26.4	33.6	50.4	40.8								7.6800	0.8643	NA
	7.2	21.6	24.0	43.2	67.2								14.1600	0.9327	NA
						12.0	14.4	19.2	40.8	52.8	139.2		22.0800	0.7335	NA
							9.6	26.4	55.2	52.8	98.4		20.4000	0.9136	NA
				0.0	21.6	28.8	48.0	74.4	163.2				28.3886	0.8319	NA
	136.8	151.2		139.2	151.2	163.2	146.4	182.4					4.2870	0.4925	NA
	52.8	60.0	67.2		81.6		93.6	103.2					7.0373	0.9981	NA
	2.4	0.0	2.4	9.6	14.4	52.8	31.2	55.2	64.8	444.0	343.2		34.3200	0.5593	NA
	0.0	0.0		2.4	4.8	4.8	21.6	45.6	24.0				4.5514	0.6240	NA
79.2		204.0	199.2										43.2000	0.8710	3.0
		194.4		223.2	240.0	213.6	237.6	331.2					16.9714	0.5905	NA
	0.0	26.4		33.6	74.4								15.6000	0.8553	NA
	2.4	2.4	0.0	2.4	24.0	19.2	19.2	14.4					2.9429	0.5545	NA
	0.0	0.0	0.0	0.0	33.6	16.8	36.0	36.0					6.1429	0.7439	NA
	0.0	2.4	0.0	4.8	0.0	2.4	7.2	14.4	43.2				3.6800	0.5259	NA
	0.0	2.4	2.4	2.4	2.4	4.8	21.6	45.6	93.6				9.0800	0.6228	NA
	31.2	60.0	19.2	31.2	26.4	12.0	24.0								
		208.8	372.0	240.0	276.0	360.0	444.0	367.2	403.2				24.2000	0.5126	NA
	232.8	336.0		388.8									48.3429	0.8662	4.0
0.0			223.2			252.0							42.0000	0.8345	6.0
		9.6		9.6	168.0								45.2571	0.5714	5.0
	0.0		2.4		0.0	2.4	9.6	12.0	148.8				11.4826	0.3494	NA
			0.0			7.2	2.4	28.8	264.0				31.6302	0.4056	NA
0.0			0.0				446.4						66.3568	0.8176	7.0
	2.4		2.4	4.8	12.0	79.2	184.8						26.5714	0.6100	NA
		0.0		2.4	2.4	2.4		52.8					7.9200	0.6017	NA
	0.0	2.4	7.2	4.8	74.4								15.1200	0.5660	5.0
	2.4	7.2	0.0	33.6									8.6400	0.5184	4.0
	9.6	14.4		16.8									2.2286	0.8622	NA
	21.6		14.4		24.0	48.0	122.4		228.0				24.8131	0.7082	NA
	52.8		43.2		50.4	79.2	50.4	52.8	67.2				1.7461	0.1601	NA
	9.6		7.2		14.4		16.8	57.6		100.8	297.6		21.6172	0.5611	NA
		24.0		62.4		60.0	108.0	93.6	273.6				26.3294	0.6051	9.0
7.2	4.8	7.2	7.2	14.4									1.6800	0.5326	NA
													Average Years Until Rehabilitation		5.3

Explanation

- Original data
- Deleted data (anomalie)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction												Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	16.1000	25.1520	54.5520	43.1040	53.3538	56.7692	67.6364	90.1000	90.8400	137.4400	133.4400	186.7200		**18.1947**	**0.6501**
Std. Dev.	31.0807	52.5363	90.0083	89.5307	93.8429	73.4916	95.3769	125.6200	102.3854	114.9908	176.1557	126.6259			
Ave + 1 Std. Dev.	47.1807	77.6883	144.5603	144.5603	147.1967	147.1967	163.0133	215.7200	215.7200	252.4308	309.5957	313.3459			
Ave - 1 Std. Dev.	-14.9807	-14.9807	-14.9807	-14.9807	-14.9807	-14.9807	-14.9807	-14.9807	-11.5454	22.4492	22.4492	60.0941			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	6	25	25	25	26	26	22	24	20	15	5	5	0		
Terminal Threshold	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		

Increase in Transverse Cracking and the Threshold
Principal Arterials



Average Slope = 18.1947
Average R^2 = 0.6501
Average Life = 40 Years [1]
Minimum Life = 40 Years [1]
Maximum Life = 40 Years [1]

[1] The calculated life exceeds the 40-year Life Cycle Cost Analysis interval.

Increase in Transverse Cracking and the Threshold

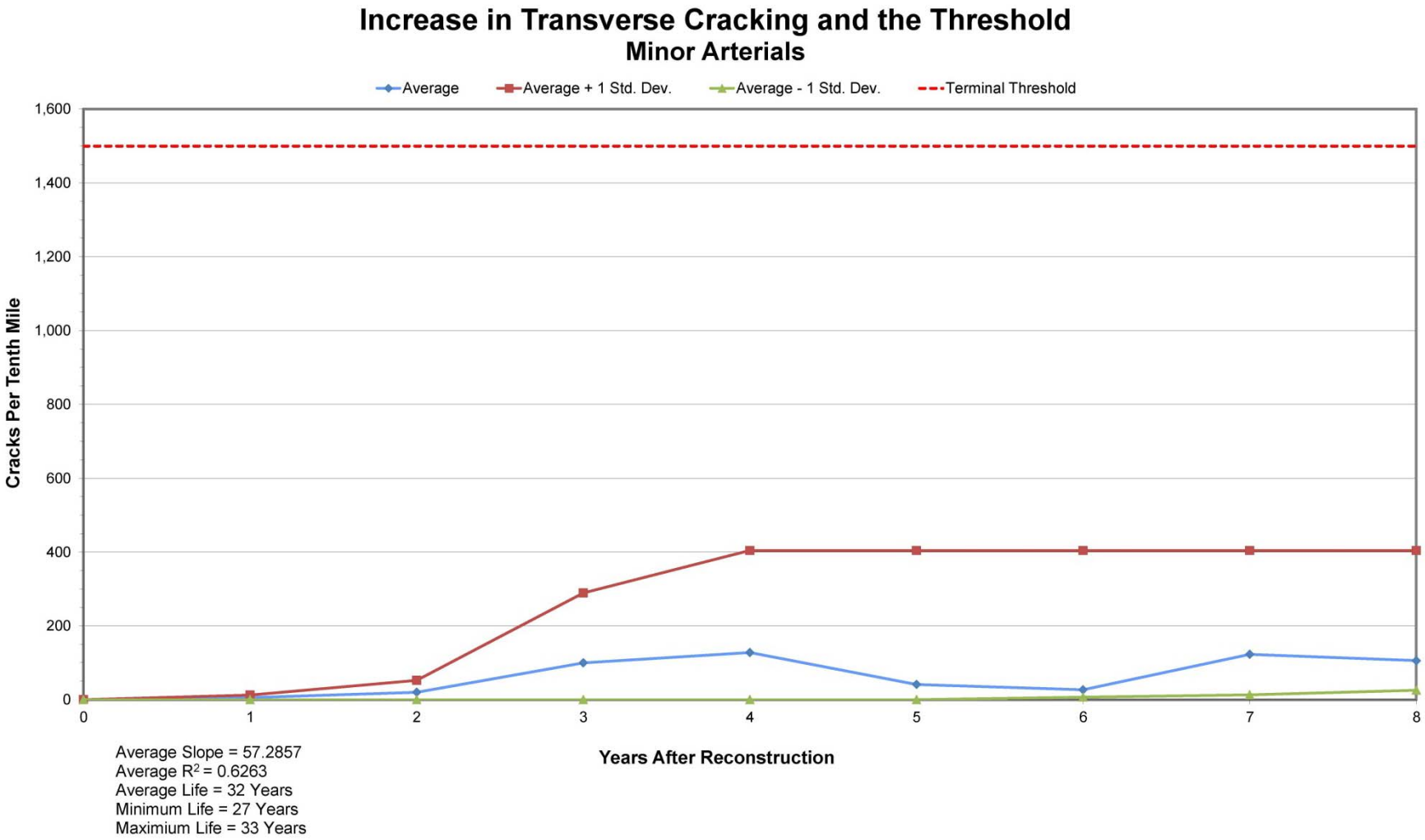
Minor Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

Transverse Cracking															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	7.2		12.0		7.2	40.8	93.6	172.8					20.4000	0.1636	NA
0.0	0.0	84.0	187.2	100.8	216.0		237.6	208.8					30.0432	0.7681	NA
	2.4	0.0	0.0	0.0	0.4	1.0	0.4	50.4					4.0643	0.3190	NA
		7.2	4.8	9.6	4.8	21.6	45.6	28.8					5.6571	0.6288	8.0
		9.6	542.4	806.4									398.4000	0.9635	4.0
	7.2	19.2	38.4	57.6	64.8								15.3600	0.9818	NA
0.0	0.0	0.2	0.0	1.4	0.6								0.2000	0.4506	NA
	2.4		12.0	7.2	9.6		237.6						35.1600	0.5845	NA
	19.2			38.4	26.4	43.2		67.2					6.2866	0.7765	NA
	Indicates the average year extrapolated from last correlatable data.												Average Years Until Rehabilitation		6.0

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction												Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	5.4857	20.0333	99.6000	127.6750	41.2250	26.6500	122.9600	105.6000					**57.2857**	**0.6263**
Std. Dev.	0.0000	6.7477	32.1269	189.6108	276.4501	73.7985	19.6431	109.7180	79.9780						
Ave + 1 Std. Dev.	0.0000	12.2334	52.1602	289.2108	404.1251	404.1251	404.1251	404.1251	404.1251						
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.0069	13.2420	25.6220						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	7	6	8	8	8	4	5	5	0	0	0	0		
Terminal Threshold	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		


Increase in Transverse Cracking and the Threshold
Minor Arterials
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
1,600
1,400
1,200
1,000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
Years After Reconstruction
Average Slope = 57.2857
Average R2 = 0.6263
Average Life = 32 Years
Minimum Life = 27 Years
Maximium Life = 33 Years

Increase in Transverse Cracking and the Threshold

Major Collectors

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

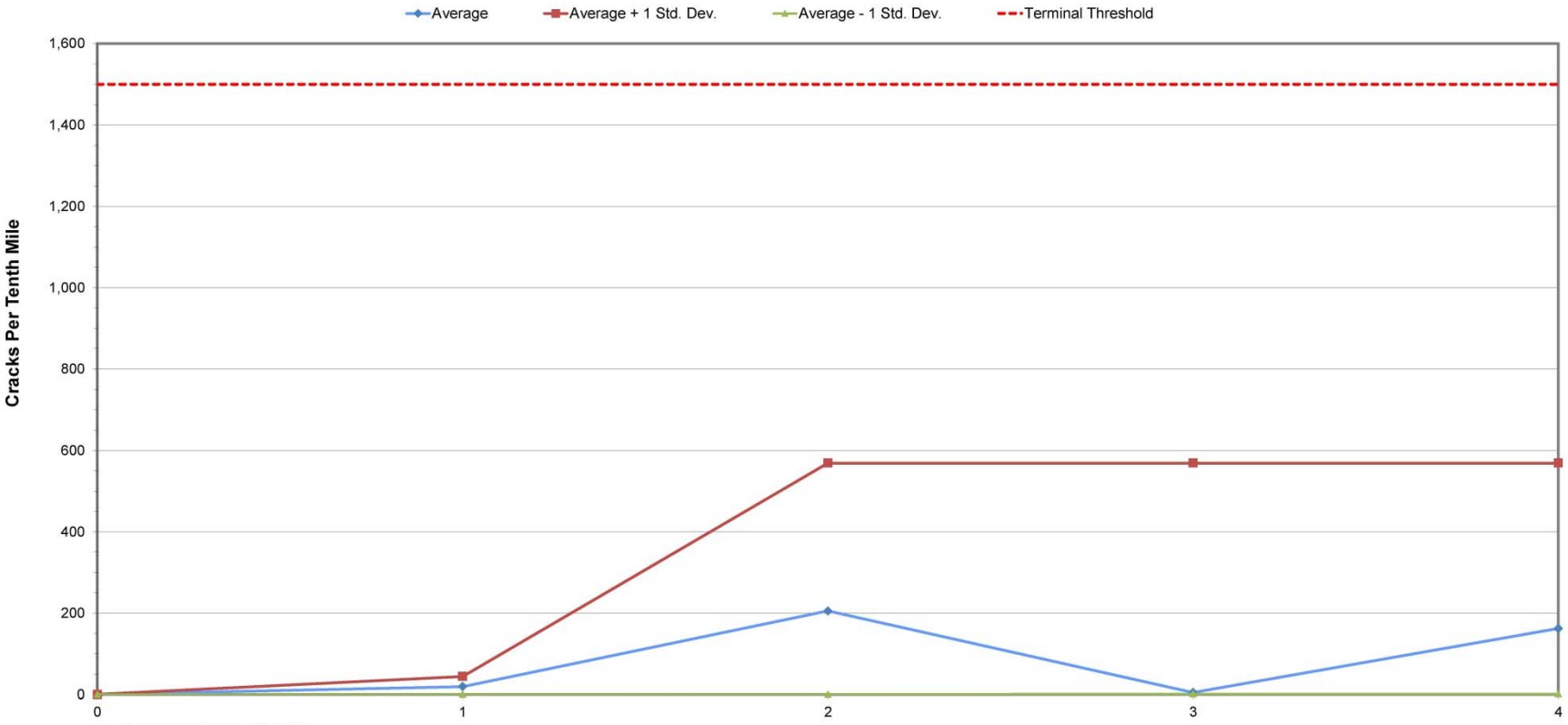
Transverse Cracking															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	48.0	67.2		124.8	139.2								24.0000	0.9891	NA
0.0		748.8		487.2									121.8000	0.4109	4.0
	4.8	0.0	7.2	24.0	40.8								9.6000	0.8114	NA
0.0	4.8	4.8	2.4	12.0	24.0								3.9771	0.7137	NA
Indicates the average year extrapolated from last correlatable data.													Average Years Until Rehabilittion		4.0

Explanation

- Original data
- Deleted data (anomalie)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Agerage R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	19.2000	205.2000	4.8000	162.0000	68.0000								**39.8443**	**0.7313**
Std. Dev.	0.0000	24.9415	363.6904	3.3941	222.6229	62.2305									
Ave + 1 Std. Dev.	0.0000	44.1415	568.8904	568.8904	568.8904	568.8904									
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	1.4059	1.4059	5.7695									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	3	4	2	4	3	0	0	0	0	0	0	0		
Terminal Threshold	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		

Increase in Transverse Cracking and theThreshold
Major Collectors



Average Slope = 39.8443
Average R^2 = 0.7314
Average Life = 40 Years [1]
Minimum Life = 28 Years
Maximum Life = 40 Years [1]

[1] The calculated life exceeds the 40-year Life Cycle Cost Analysis interval

Increase in Transverse Cracking and the Threshold

Statewide

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

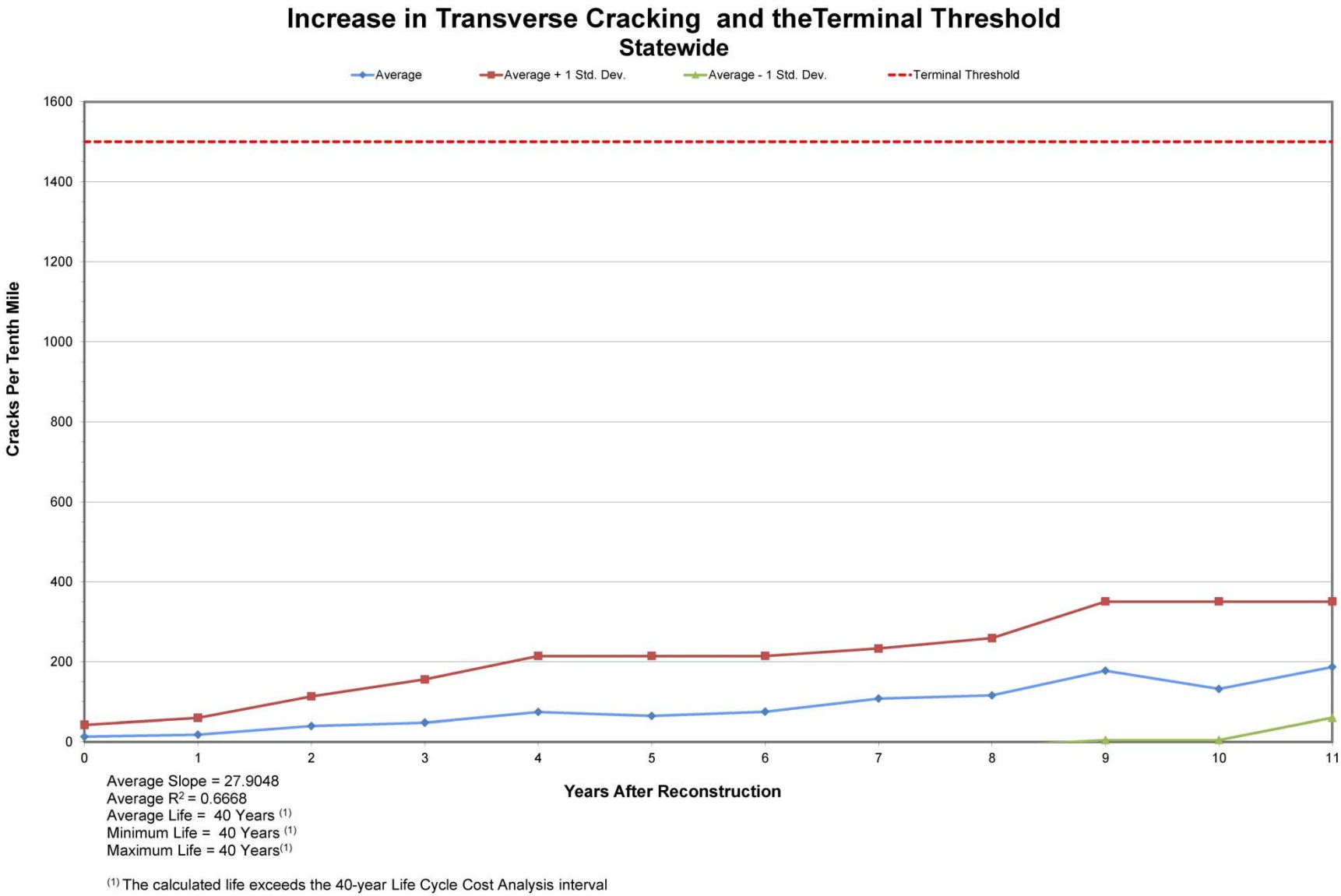
Transverse Cracking															
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	7.2		12.0		7.2	40.8	93.6	172.8	256.8				28.9940	0.1344	NA
	2.4		4.8		2.4		2.4		2.4	16.8	55.2		3.2805	0.3902	NA
3.0		3.0		4.8		12.0							1.4400	0.7529	NA
	48.0	67.2		124.8	139.2								24.0000	0.9891	NA
	38.4		45.6	62.4	57.6	55.2	64.8	204.0	189.6				19.6271	0.6157	NA
	0.0	0.0	0.0	0.0	12.0								2.4000	0.5000	NA
0.0		2.4		36.0		26.4	33.6	38.4	84.0	74.4			7.6281	0.7896	4.0
7.2	19.2	26.4	33.6	50.4	40.8								7.6800	0.8643	NA
	7.2	21.6	24.0	43.2	67.2								14.1600	0.9327	NA
						12.0	14.4	19.2	40.8	52.8	139.2		22.0800	0.7335	NA
							9.6	26.4	55.2	52.8	98.4		20.4000	0.9136	NA
				0.0	21.6	28.8	48.0	74.4	163.2				28.3886	0.8319	NA
	136.8	151.2		139.2	151.2	163.2	146.4	182.4					4.2870	0.4925	NA
	52.8	60.0	67.2		81.6		93.6	103.2					7.0373	0.9981	NA
	2.4	0.0	2.4	9.6	14.4	52.8	31.2	55.2	64.8	444.0	343.2		34.3200	0.5593	NA
	0.0	0.0		2.4	4.8	4.8	21.6	45.6	24.0				4.5514	0.6240	NA
79.2		204.0	199.2										43.2000	0.8710	3.0
	0.0	194.4		223.2	240.0	213.6	237.6	331.2					32.6522	0.6919	NA
	0.0	14.4	7.2	45.6	148.8								32.8800	0.7137	45.6
0.0	4.8	2.4	2.4	146.4	206.4								41.6229	0.7188	36.0
	0.0	26.4		33.6	74.4								15.6000	0.8553	NA
	2.4	2.4	0.0	2.4	24.0	19.2	19.2	14.4					2.9429	0.5545	NA
	0.0	0.0	0.0	0.0	33.6	16.8	36.0	36.0					6.1429	0.7439	NA
	0.0	2.4	0.0	4.8	0.0	2.4	7.2	14.4	43.2				3.6800	0.5259	NA
	0.0	2.4	2.4	2.4	2.4	4.8	21.6	45.6	93.6				9.0800	0.6228	NA
	31.2	60.0	19.2	31.2	26.4	12.0	24.0								
	0.0	84.0	187.2	100.8	216.0		237.6	208.8					28.2348	0.6816	NA
	2.4	0.0	0.0	0.0	4.8	12.0	4.8	50.4					4.7714	0.4678	NA
		7.2	4.8	9.6	4.8	21.6	45.6	28.8					5.6571	0.6288	8.0
		9.6	542.4	806.4									398.4000	0.9635	4.0
		208.8	372.0	240.0	276.0	360.0	444.0	367.2	403.2				24.2000	0.5126	NA
	232.8	336.0		388.8									48.3429	0.8662	4.0
0.0			223.2			252.0							42.0000	0.8345	6.0
		9.6		9.6	168.0								45.2571	0.5714	5.0
	0.0		2.4		0.0	2.4	9.6	12.0	148.8				11.4826	0.3494	NA
			0.0			7.2	2.4	28.8	264.0				31.6302	0.4056	NA
0.0			0.0				446.4						66.3568	0.8176	7.0
	2.4		2.4	4.8	12.0	79.2	184.8						26.5714	0.6100	NA
	4.8	9.6	19.2	33.6	177.6	235.2	278.4	285.6					48.8286	0.8997	30.7
	2.4	7.2	16.8	21.6	81.6	129.6	136.8	148.8					24.6571	0.9114	NA
	4.8	9.6	43.2	223.2		261.6	343.2	691.2	732.0				93.2000	0.8905	16.1
	7.2	14.4	28.8	180.0		163.2	261.6		403.2				49.1448	0.9159	30.5
	4.8	0.0	7.2	24.0	40.8	26.4	12.0	28.8	64.8	100.8			8.3345	0.6542	NA
	4.8	4.8	2.4	12.0	24.0	19.2	31.2	48.0	124.8	211.2			18.0509	0.6504	NA
	7.2	19.2	38.4	57.6	64.8								15.3600	0.9818	NA
	0.0	2.4	0.0	16.8	7.2								2.8800	0.4138	NA
		0.0		2.4	2.4	2.4		52.8					7.9200	0.6017	NA
	0.0	2.4	7.2	4.8	74.4								15.1200	0.5660	NA
	2.4	7.2	0.0	33.6									8.6400	0.5184	5.0
	2.4		12.0	7.2	9.6		237.6						35.1600	0.5845	NA
	9.6	14.4	0.0	16.8									0.7200	0.0157	NA
	21.6		14.4		24.0	48.0	122.4		228.0				24.8131	0.7082	NA
	52.8		43.2		50.4	79.2	50.4	52.8	67.2				1.7461	0.1601	NA
	9.6		7.2		14.4		16.8	57.6		100.8	297.6		21.6172	0.5611	NA
		24.0		62.4		60.0	108.0	93.6	273.6				26.3294	0.6051	9.0
	4.8	7.2	7.2	14.4									2.8800	0.8000	NA
	19.2			38.4	26.4	43.2		67.2					6.2866	0.7765	NA

Indicates the average year extrapolated from last correlatable data.

Average Years Until Rehabilitation **14.3**

Explanation
Original data
Deleted data (anomalie)
Deleted data (too few years for correlation)
Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	12.7714	17.8286	39.4683	47.6571	74.3455	64.2732	74.7636	107.7333	115.6645	177.4857	131.7000	186.7200		**27.9048**	**0.6668**
Std. Dev.	29.4157	41.8090	73.7804	107.9663	139.8964	75.1329	93.5925	125.1750	143.3993	172.9324	138.7170	126.6259			
Ave + 1 Std. Dev.	42.1872	59.6375	113.2487	155.6234	214.2419	214.2419	214.2419	232.9083	259.0638	350.4181	350.4181	350.4181			
Ave - 1 Std. Dev.	-16.6443	-16.6443	-16.6443	-16.6443	-16.6443	-10.8597	-10.8597	-10.8597	-10.8597	4.5533	4.5533	60.0941			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	7	42	41	42	44	41	33	36	31	21	8	5	0		
Terminal Threshold	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		


Increase in Transverse Cracking and theTerminal Threshold
Statewide
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
1600
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
9
10
11
Years After Reconstruction
Average Slope = 27.9048
Average R2 = 0.6668
Average Life = 40 Years (1)
Minimum Life = 40 Years (1)
Maximum Life = 40 Years(1)
(1) The calculated life exceeds the 40-year Life Cycle Cost Analysis interval

Increase in Longitudinal Cracking and the Threshold
Interstates

Highway	Starting MM	Ending MM	Length (miles)	Direction
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2

Longitudinal Cracking - Interstates

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
0.0	0.0	67.0	0.0	0.0	1009.6								142.3143	0.4267	3.5
	0.0	21.2	10.0	0.0	0.0								-2.1200	0.1267	NA
	0.0	0.0	0.0	26.6	0.0	112.0		436.6					54.1705	0.6531	9.2
0.0	0.0	0.0	0.0	0.0	12.8	603.0		486.2					71.7163	0.5721	7.0
	0.0	41.8		25.8	245.0	800.6	1525.8	1066.0					201.8225	0.7278	2.5
	0.0		134.8	3.2	905.6		950.4	705.4					139.3200	0.6314	3.6

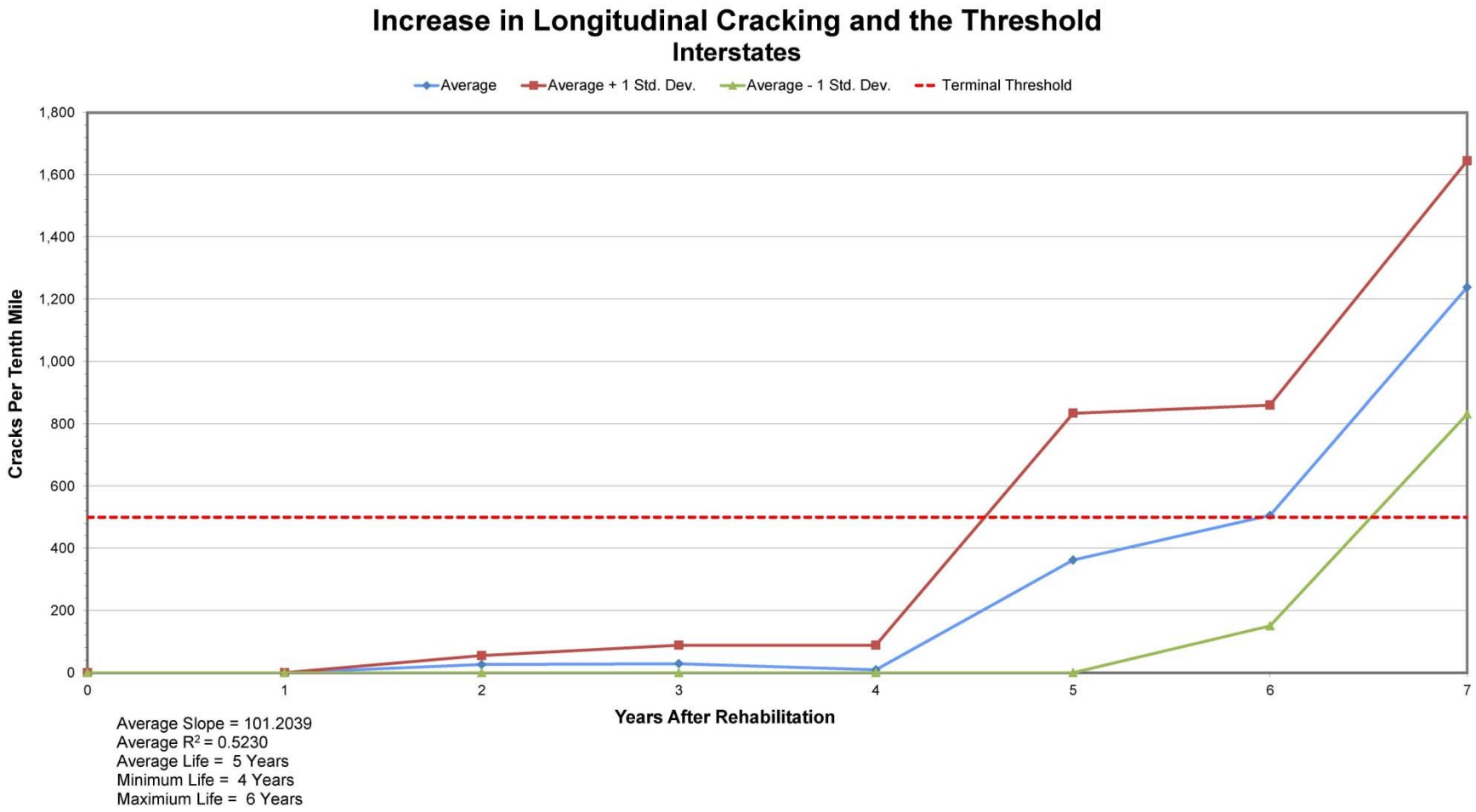
Indicates the average year extrapolated from last correlatable data.

Average Years Until Rehabilitation 5.2

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.0000	26.0000	28.9600	9.2667	362.1667	505.2000	########	673.5500					**101.2039**	**0.5230**
Std. Dev.	0.0000	0.0000	28.7475	59.3246	13.1774	471.7211	354.5647	406.8692	286.5175						
Ave + 1 Std. Dev.	0.0000	0.0000	54.7475	88.2846	88.2846	833.8878	859.7647	########	########						
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	150.6353	831.2308	831.2308						
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	6	5	5	6	6	3	2	4	0	0	0	0		
Terminal Threshold	500	500	500	500	500	500	500	500	500	500	500	500	500		


Increase in Longitudinal Cracking and the Threshold
Interstates
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0
1
2
3
4
5
6
7
Years After Rehabilitation
Average Slope = 101.2039
Average R² = 0.5230
Average Life = 5 Years
Minimum Life = 4 Years
Maximium Life = 6 Years

Increase in Longitudinal Cracking and the Threshold

Principal Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1

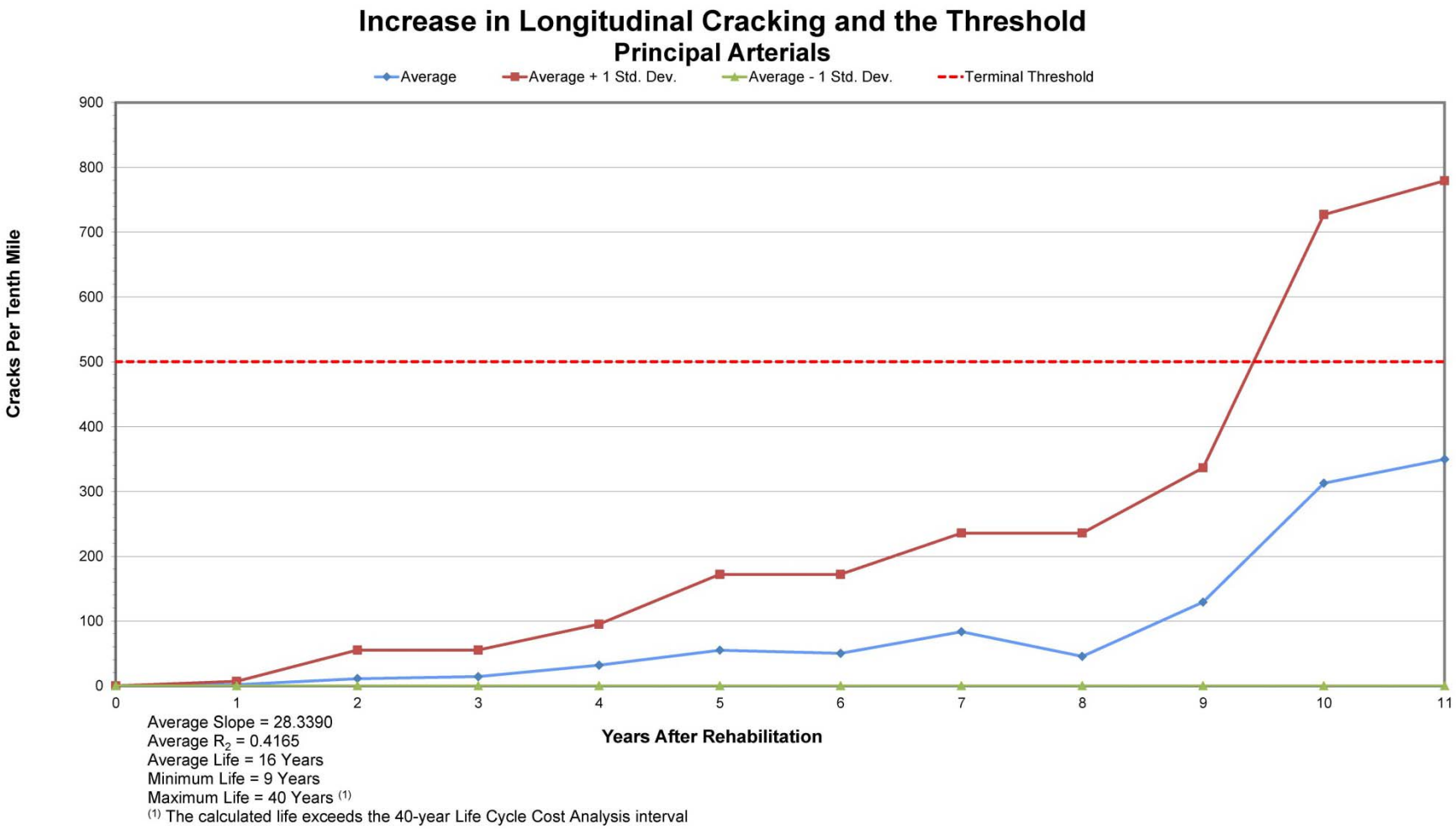
Longitudinal Cracking - Principal Arterials

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.0		0.0		1.4		0.0		16.4	0.0	15.0		1.2430	0.3779	NA
0.0		0.0		48.4	0.0	17.4							3.2017	0.1337	NA
	7.2	0.0		0.0	75.2	0.0	21.0	0.0	21.0				1.1910	0.0169	NA
	0.0	0.0	0.0	0.0	0.0										
	0.0	0.0	28.8	0.0	0.0										
	0.0	0.0	1.8	0.0	41.4								8.2800	0.5101	NA
						37.0	0.0	0.0	0.0	0.0	0.0				
							2.0	4.8	9.0	0.0	71.2		13.3600	0.4872	37.4
	0.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	8.4				0.3100	0.0246	NA
	0.0	0.0	24.8	13.6	13.6	1.0	0.0	273.6					21.9500	0.3237	22.8
	0.0	0.0	0.0		121.0	121.0							29.5465	0.8547	6.0
	0.0	0.0	0.0	201.6	0.0	196.6	306.0		370.0	665.8	552.6		65.3174	0.8455	7.7
	0.0	0.0	7.2	0.0	3.6	0.0	0.0	33.8	3.4				1.6767	0.1752	NA
		44.0	6.6	3.6	1.2	6.8		6.2	0.0						
	0.0	8.4	0.4	14.0	5.6	46.0	3.4	0.0					1.2310	0.0381	NA
		0.0	0.0	0.0	0.0										
	1.8	0.0	0.0	0.0	1.8	1.6	0.0	0.0							
	0.0	0.0	0.0	0.0	11.4	0.0	13.6	0.0					0.9452	0.1585	NA
	0.0	0.0	35.8	0.0	31.0	0.0	11.6	0.0	0.0						
	0.0	0.0	0.0	3.6	2.0	6.0	9.6	0.0	7.2				0.8400	0.3944	NA
	0.0	0.0	8.8	4.2	1.6	4.4	0.0						0.0571	0.0014	NA
	3.6	14.8		0.0	5.2	0.0	35.2						2.2584	0.1485	NA
		0.0	30.0	38.6	382.2	462.0	489.2						116.7314	0.8715	4.3
	24.4	226.6	129.6	106.4		183.0	313.0						30.2919	0.4879	16.5
	0.0		0.0		138.4		236.6		527.6	207.2	1104.6		80.8396	0.5972	6.2
		0.0		41.2	0.0	0.0		56.2	6.0	1134.2			85.6023	0.3377	5.8
	0.0		0.0		0.0	6.8	0.0	22.0	544.8				40.3281	0.3100	12.4
	0.0		55.6		0.0	4.2	0.0	10.0	487.8				32.6018	0.2578	15.3
0.0			0.0	0.0			0.0	0.0	1.8				0.1173	0.2997	NA
	0.0		102.8	23.2	494.4								97.9314	0.5267	5.1
		0.0		0.0	0.0	0.0	9.6	8.2					1.6229	0.5765	NA
	0.0	0.0	0.0	0.0	0.0	0.0									
	0.0	0.0	0.0	265.6									79.6800	0.6000	6.3
	0.0	3.0	0.0	14.6									4.0800	0.5751	NA
	12.6		0.0		148.0	156.4	449.2	405.0	279.6				52.5790	0.6949	9.5
	0.0		0.0		0.0	0.0	0.0	0.0	0.0						
	0.0		0.0		221.6		265.0	117.6		458.8	353.8		41.0918	0.7393	12.2
		0.0		12.4			0.0	14.0	39.8	35.8			4.1789	0.5580	NA
	0.0		0.0	108.8									31.0857	0.5714	16.1
													Average Years Until Rehabilitation		**12.2**

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0	1.710345	10.99259	13.94194	31.54483	54.85806	50.008	83.26923	45.30476	129.0444	312.725	349.5333		**28.3390**	**0.4165**
Std. Dev.	0	5.131579	43.99281	30.67682	63.40678	117.0117	105.3018	152.4242	103.6384	207.3641	414.3902	429.636			
Ave + 1 Std. Dev.	0	6.841924	54.98541	54.98541	94.95161	171.8698	171.8698	235.6934	235.6934	336.4085	727.1152	779.1693			
Ave - 1 Std. Dev.	0	0	0	0	0	0	0	0	0	0	0	0			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	29	27	31	29	31	25	26	21	18	8	6	0		
Terminal Threshold	500	500	500	500	500	500	500	500	500	500	500	500	500		


Increase in Longitudinal Cracking and the Threshold
Principal Arterials
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
11
Years After Rehabilitation
Average Slope = 28.3390
Average R_2 = 0.4165
Average Life = 16 Years
Minimum Life = 9 Years
Maximum Life = 40 Years (1)
(1) The calculated life exceeds the 40-year Life Cycle Cost Analysis interval

Increase in Longitudinal Cracking and the Threshold
Minor Arterials

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
052A	36.9	42.0	5.1	1
007D	68.1	69.4	1.3	1

Longitudinal Cracking - Minor Arterials

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.0				0.0	6.2	113.0	25.2	197.2				18.8750	0.4334	26.5
	0.0	26.0	41.0	12.6	6.6	0.0	155.2	48.4					10.1881	0.2358	NA
0.0	1.2	0.0	0.0	0.0	7.4	1.2	0.0	2.2					0.2500	0.0807	NA
		0.8		6.4	0.0	13.2	8.2	0.0	762.2				68.6164	0.3336	7.3
	0.0	4.2		0.0	55.6	163.0	0.0	0.0	449.6				32.0847	0.3259	15.6
0.0	0.0	3.8	18.6	6.2	8.0								2.0971	0.3213	NA
	0.0	8.8	0.2	0.0	4.2										
	0.0		0.0	0.0	0.0	0.0	0.0								
	0.0			0.0	0.0	71.6	29.8	106.8					13.5211	0.5528	37.0

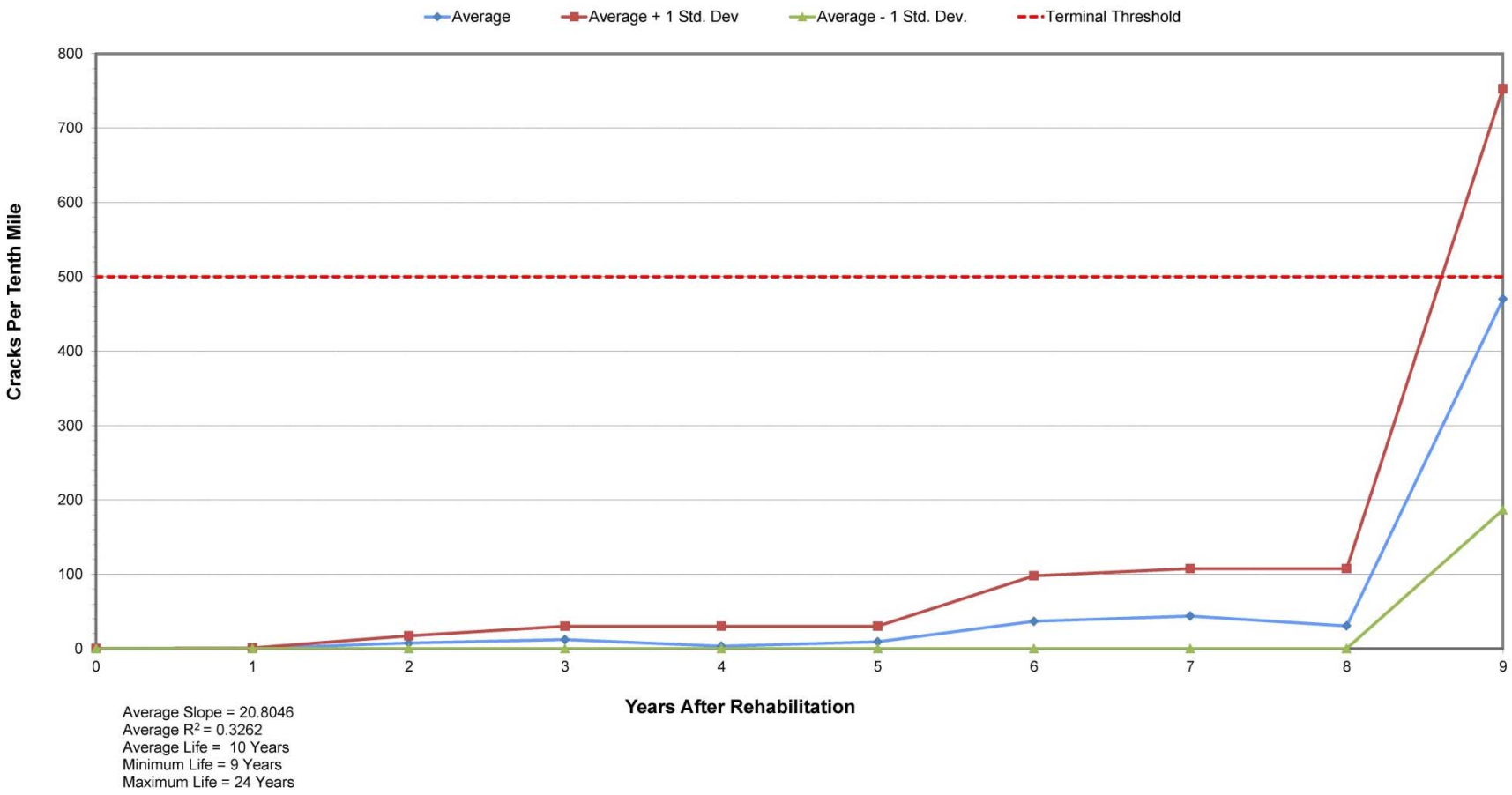
Indicates the average year extrapolated from last correlatable data.

Average Years Until Rehabilitation **16.5**

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.1500	7.2667	11.9592	3.1500	9.0889	36.4571	43.7429	30.4333	469.6667				**20.8046**	**0.3262**
Std. Dev.	0.0000	0.4243	9.6885	18.1100	4.7627	17.7759	61.3811	63.7930	42.0275	283.0340					
Ave + 1 Std. Dev.	0.0000	0.5743	16.9551	30.0692	30.0692	30.0692	97.8382	107.5358	107.5358	752.7007					
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	186.6327					
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	8	6	5	8	9	7	7	6	3	0	0	0		
Terminal Threshold	500	500	500	500	500	500	500	500	500	500	500	500	500		


Increase in Longitudinal Cracking and the Threshold
Minor Arterials
Average
Average + 1 Std. Dev
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
Years After Rehabilitation
Average Slope = 20.8046
Average R² = 0.3262
Average Life = 10 Years
Minimum Life = 9 Years
Maximum Life = 24 Years

Increase in Longitudinal Cracking and the Threshold

Major Collectors

Highway	Starting MM	Ending MM	Length (miles)	Direction
079A	0.0	1.3	1.3	1
012A	51.7	55.6	3.9	1
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2

Longitudinal Cracking - Major Collectors

0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab
	0.0	13.6	3.0	0.0	0.0										
			0.0		17.2		0.0	0.0	8.6	0.0					
0.0	0.0	0.0	0.0	0.0		3.2	0.0	0.0	3.6	271.6			12.5055	0.2605	40.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0			3.6364	0.2500	NA

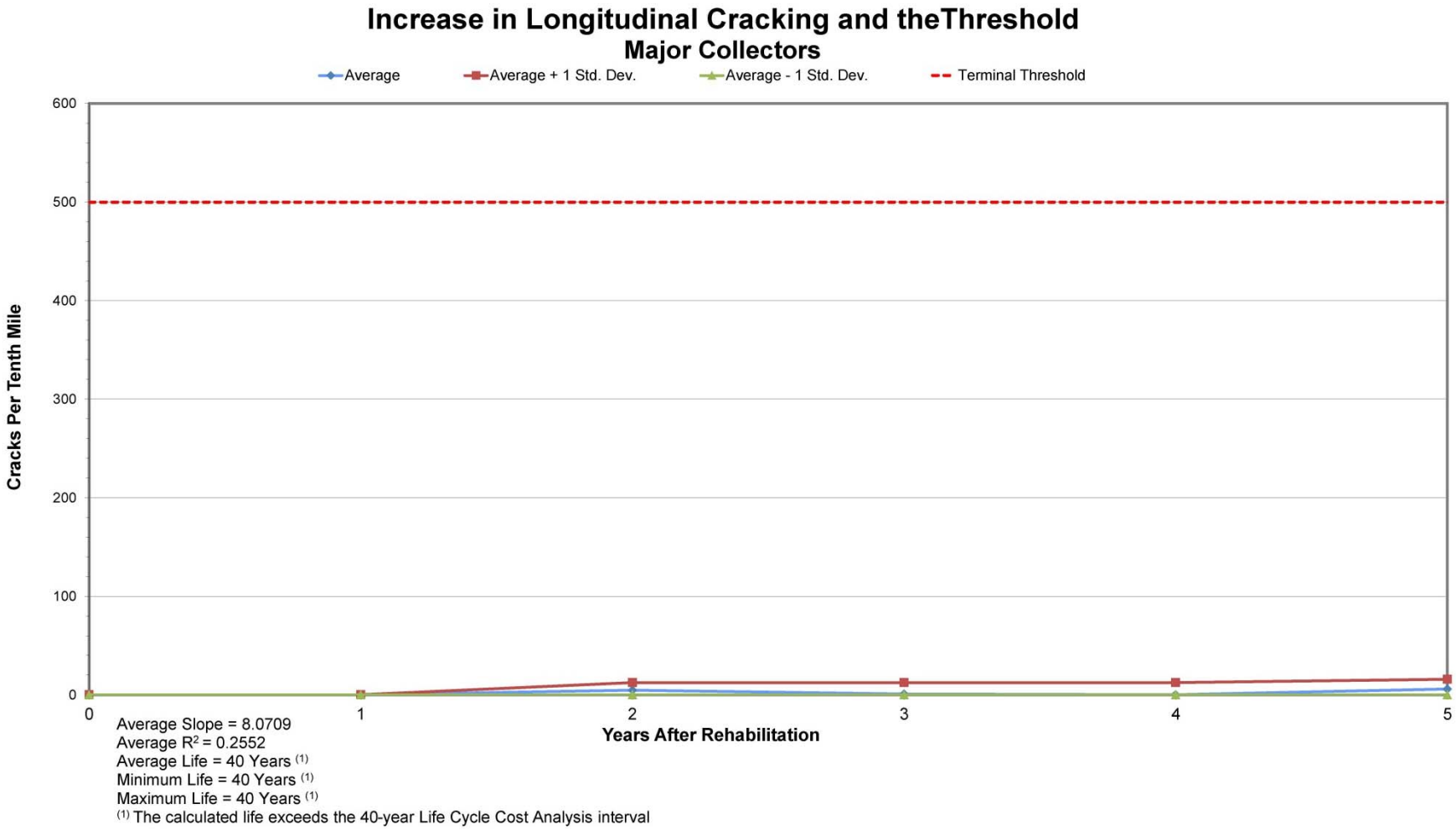
Indicates the average year extrapolated from last correlatable data.

Average Years Until Rehabilitation 40.0

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.0000	4.5333	0.7500	0.0000	5.7333								**8.0709**	**0.2552**
Std. Dev.	0.0000	0.0000	7.8520	1.5000	0.0000	9.9304									
Ave + 1 Std. Dev.	0.0000	0.0000	12.3853	12.3853	12.3853	15.6638									
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000									
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	2	3	3	4	3	3	2	3	3	3	3	0	0		
Terminal Threshold	500	500	500	500	500	500	500	500	500	500	500	500	500		


Increase in Longitudinal Cracking and theThreshold
Major Collectors
Average
Average + 1 Std. Dev.
Average - 1 Std. Dev.
Terminal Threshold
Cracks Per Tenth Mile
600
500
400
300
200
100
0
0
1
2
3
4
5
Years After Rehabilitation
Average Slope = 8.0709
Average R² = 0.2552
Average Life = 40 Years (1)
Minimum Life = 40 Years (1)
Maximum Life = 40 Years (1)
(1) The calculated life exceeds the 40-year Life Cycle Cost Analysis interval

Increase in Longitudinal Cracking and the Threshold
Statewide

Highway	Starting MM	Ending MM	Length (miles)	Direction
009D	109.0	114.5	5.5	1
040A	244.3	247.1	2.8	1
040A	247.1	249.1	2.0	1
079A	0.0	1.3	1.3	1
085B	186.2	187.4	1.2	1
285D	233.0	235.0	2.0	1
012A	51.7	55.6	3.9	1
021B	148.0	149.4	1.4	1
021B	148.0	149.4	1.4	2
021B	150.0	151.0	1.0	1
021B	150.0	151.0	1.0	2
021B	151.0	153.6	2.6	2
024A	277.8	279.5	1.7	1
024A	278.0	279.5	1.5	2
024A	279.5	282.5	2.9	1
024G	312.2	313.9	1.7	1
024G	312.2	313.8	1.6	2
024G	313.9	318.9	5.1	1
025A	79.6	85.5	5.9	1
025A	79.6	85.5	5.9	2
050B	338.0	341.0	3.0	1
083A	20.4	21.8	1.4	1
083A	20.4	21.7	1.3	2
085A	132.5	134.0	1.5	1
085A	132.5	134.0	1.5	2
085A	134.0	135.1	1.1	1
085A	134.0	135.1	1.1	2
115A	24.2	26.0	1.8	1
115A	24.3	25.5	1.2	2
115A	35.8	37.1	1.3	2
115A	36.1	38.2	2.1	1
040A	229.9	232.4	2.5	1
040A	229.9	232.4	2.5	2
050A	46.3	53.3	7.0	1
050A	53.3	59.0	5.7	1
050A	59.0	65.4	6.4	1
050A	65.4	70.5	5.1	1
050A	65.4	70.5	5.1	2
050A	103.0	109.4	6.4	1
070A	5.0	11.6	6.6	1
070A	5.0	11.6	6.6	2
070A	22.0	37.0	15.0	1
070A	22.0	37.0	15.0	2
092A	0.0	4.0	4.0	1
092A	0.0	4.0	4.0	2
133A	0.0	5.0	5.0	1
133A	5.0	11.0	6.0	1
014C	176.0	194.5	18.5	1
034A	88.7	90.8	2.1	1
034A	88.7	90.8	2.1	2
052A	36.9	42.0	5.1	1
160A	21.4	23.1	1.7	1
160A	55.2	56.7	1.5	1
160A	158.6	163.9	5.4	1
160A	163.9	168.8	4.9	1
285B	100.4	111.6	11.7	1
550A	0.8	3.0	2.2	1
007D	68.1	69.4	1.3	1

Longitudinal Cracking - Statewide

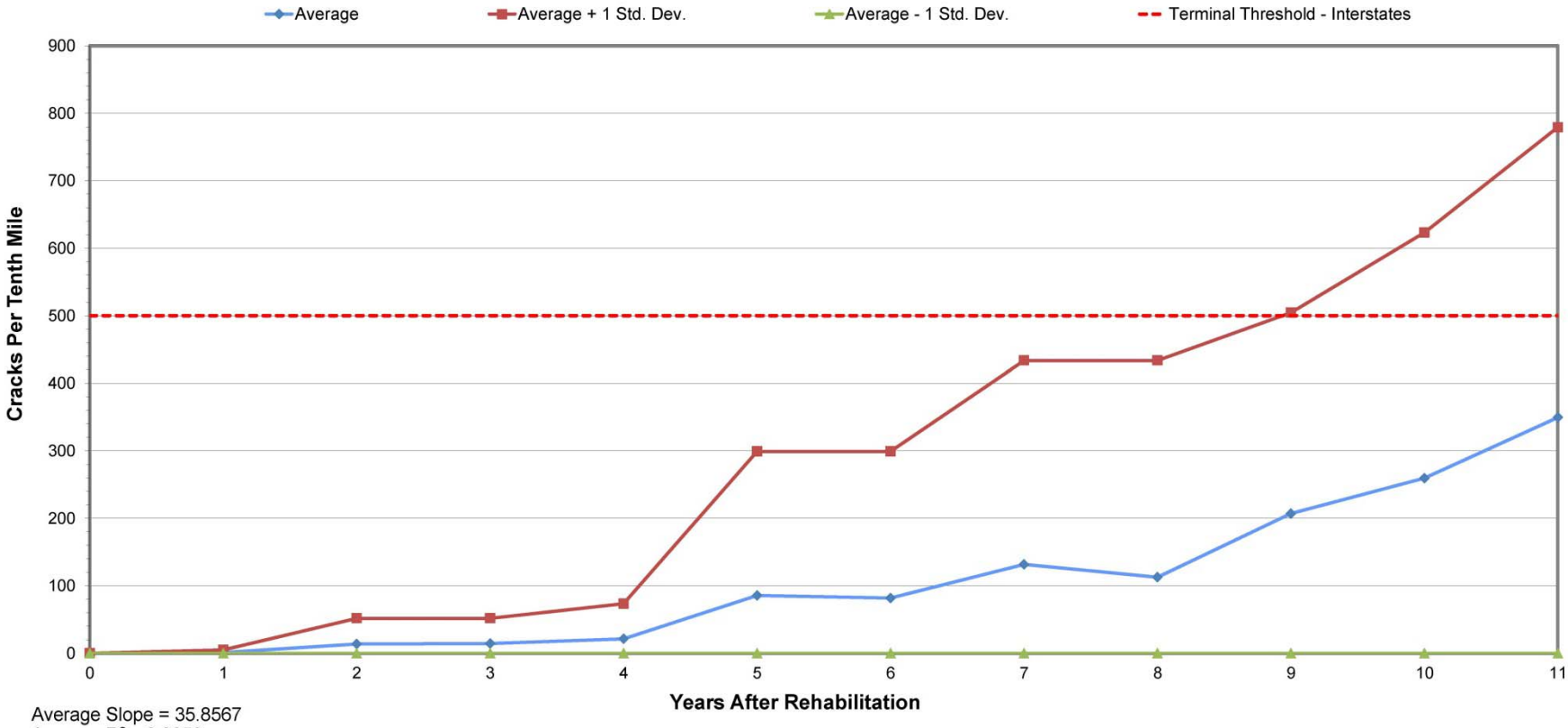
0	1	2	3	4	5	6	7	8	9	10	11	12	Slope	R^2	Yrs. Until Rehab.
	0.0				0.0	6.2	113.0	25.2	197.2				18.8750	0.4334	26.5
	0.0		0.0		1.4		0.0		16.4	0.0	15.0		1.2430	0.3779	NA
		0.0		48.4	0.0	17.4							2.0971	0.0246	NA
	0.0	13.6	3.0	0.0	0.0										
	0.0		7.2	0.0		0.0	75.2	0.0	21.0				3.5339	0.1344	NA
	0.0	0.0	0.0	0.0	0.0										
			0.0		17.2		0.0	0.0	8.6	0.0					
	0.0	0.0	28.8	0.0	0.0										
	0.0	0.0	1.8	0.0	41.4								8.2800	0.5101	NA
						37.0	0.0	0.0	0.0	0.0	0.0				
							2.0	4.8	9.0	0.0	71.2		13.3600	0.4872	37.4
0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	8.4				0.3673	0.0462	NA
	0.0	0.0	24.8	0.0	13.6	1.0	0.0	273.6					22.1119	0.3238	22.6
	0.0	0.0	0.0		332.0	121.0							49.1744	0.4962	10.2
	0.0	0.0	0.0	201.6	0.0	196.6	306.0		370.0	665.8	552.6		65.3174	0.8455	7.7
	0.0	0.0	7.2	0.0	3.6	0.0	0.0	33.8	3.4				1.6767	0.1752	NA
		44.0	6.6	3.6	1.2	6.8		6.2	0.0						
	0.0	8.4	0.4	14.0	5.6	46.0	3.4	0.0					1.2310	0.0381	NA
0.0	0.0	67.0	0.0	0.0	1009.6								142.3143	0.4267	3.5
	0.0	21.2	10.0	0.0	0.0										
		0.0	0.0	0.0	0.0										
	1.8	0.0	0.0	0.0	1.8	1.6	0.0	0.0							
	0.0	0.0	0.0	0.0	11.4	0.0	13.6	0.0					0.9452	0.1585	NA
	0.0	0.0	35.8	0.0	31.0	0.0	11.6	0.0	0.0						
	0.0	0.0	0.0	3.6	2.0	6.0	9.6	0.0	7.2				0.8400	0.3944	NA
	0.0	0.0	8.8	4.2	1.6	4.4	0.0						0.0571	0.0014	NA
	3.6	14.8	22.6	0.0	5.2	0.0	35.2						1.7071	0.0768	NA
	0.0	26.0	41.0	12.6	6.6	0.0	155.2	48.4					10.1881	0.2358	NA
	1.2	0.0	0.0	0.0	7.4	1.2	0.0	2.2					0.2143	0.0434	NA
		0.8		6.4	0.0	13.2	8.2	0.0	762.2				68.6164	0.3336	7.3
	0.0	4.2		0.0	55.6	163.0	0.0	0.0	449.6				32.0847	0.3259	15.6
		0.0	30.0	38.6	382.2	462.0	489.2						116.7314	0.8715	4.3
	24.4	226.6	129.6	106.4		183.0	313.0						30.2919	0.4879	16.5
	0.0		0.0		138.4		236.6		527.6	207.2	1104.6		80.8396	0.5972	6.2
		0.0		41.2	0.0	0.0		56.2	6.0	1134.2			85.6023	0.3377	5.8
	0.0		0.0		0.0	6.8	0.0	22.0	544.8				40.3281	0.3100	12.4
	0.0		55.6		0.0	4.2	0.0	10.0	487.8				32.6018	0.2578	15.3
0.0			0.0	0.0			0.0	0.0	1.8				0.1173	0.2997	NA
	0.0		102.8	23.2	494.4								97.9314	0.5267	5.1
	0.0	0.0	0.0	26.6	0.0	112.0		436.6					54.1705	0.6531	9.2
0.0	0.0	0.0	0.0	0.0	12.8	603.0		486.2					71.7163	0.5721	7.0
	0.0	41.8		25.8	245.0	800.6	1525.8	1066.0	1077.8				180.4414	0.7316	2.8
	0.0		134.8	3.2	905.6		950.4	705.4	559.8				102.2121	0.4989	4.9
0.0	0.0	0.0	0.0	0.0		3.2	0.0	0.0	3.6	271.6			12.5055	0.2605	40.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0			3.6364	0.2500	NA
	0.0	3.8	18.6	6.2	8.0								1.8400	0.1737	NA
	0.0	8.8	0.2	0.0	4.2										
		0.0		0.0	0.0	0.0	9.6	8.2					1.6229	0.5765	NA
	0.0	0.0	0.0	0.0	0.0	0.0									
	0.0	0.0	0.0	265.6									79.6800	0.6000	6.3
	0.0		0.0	0.0	0.0	0.0	0.0								
	0.0	3.0	0.0	14.6									4.0800	0.5751	NA
	12.6		0.0		148.0	156.4	449.2	405.0	279.6				52.5790	0.6949	9.5
	0.0		0.0		0.0	0.0	0.0	0.0	0.0						
	0.0		0.0		221.6		265.0	117.6		458.8	353.8		41.0918	0.7393	12.2
		0.0		12.4			0.0	14.0	39.8	35.8			4.1789	0.5580	NA
	0.0	69.0	0.0	108.8									25.7400	0.3810	19.4
	0.0			0.0	0.0	71.6	29.8	106.8					13.5211	0.5528	37.0
	Indicates the average year extrapolated from last correlatable data.												Rhabilitation		13.8

Explanation

- Original data
- Deleted data (anomaly)
- Deleted data (too few years for correlation)
- Deleted due to rehabilitation

	Years After Initial Construction													Average Slope	Average R^2
	0	1	2	3	4	5	6	7	8	9	10	11	12		
Average	0.0000	0.9478	13.4878	14.2467	21.3478	85.5917	81.7351	131.6211	112.5941	206.9846	259.4000	349.5333		**35.8567**	**0.3953**
Std. Dev.	0.0000	4.0289	38.2561	31.4808	52.0474	213.6554	177.2078	302.1160	240.0904	297.5854	363.9237	429.6360			
Ave + 1 Std. Dev.	0.0000	4.9767	51.7439	51.7439	73.3952	299.2471	299.2471	433.7371	433.7371	504.5700	623.3237	779.1693			
Ave - 1 Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
Years	0	1	2	3	4	5	6	7	8	9	10	11	12		
Count	6	46	41	47	46	48	37	38	34	26	11	6	0		
Terminal Thresholde - Interstates	500	500	500	500	500	500	500	500	500	500	500	500	500		

Increase in Longitudinal Cracking and theThreshold
Statewide Average



Average Slope = 35.8567
Average R^2 = 0.3953
Average Life = 15 Years
Minimum Life = 9 Years
Maximum Life = 40 Years [1]
[1] The calculated life exceeds the 40-year Life Cycle Cost Analysis interval

APPENDIX C

DEFINITIONS

DEFINITIONS

Analysis Period
The period of time for which the economic analysis is to be made. Ordinarily, the period will include at least one rehabilitation activity.

Design Period
The number of years from initial construction or rehabilitation until terminal service life. This term should not be confused with pavement life or analysis period. By adding asphalt overlays as required, pavement life may be extended indefinitely, or until geometric considerations or other factors make the pavement obsolete. The initial design period is the number of years for which the volume and type of traffic and the resultant wheel or axle load application are forecast, and on which the pavement designs are calculated.

Economic Analysis
A justification of the expenditure required and the comparative worth of a proposed improvement as compared to other alternate plans.

Expressway
A divided arterial highway for through traffic with full or partial control of access and generally with grade separations at major intersections.

Fatigue Cracking
A series of small, jagged, interconnecting cracks caused by failure of the asphalt concrete surface under repeated traffic loading (also referred to as alligator cracking).

Freeway
An expressway with full control of access and all at-grade intersections eliminated.

Functional Classification Map
A map produced by CDOT showing the location various roadways throughout the state and there functional classification which is dependent on the type and volume of traffic over time. Figure 1 is the 2012 CDOT Function Classification Map.

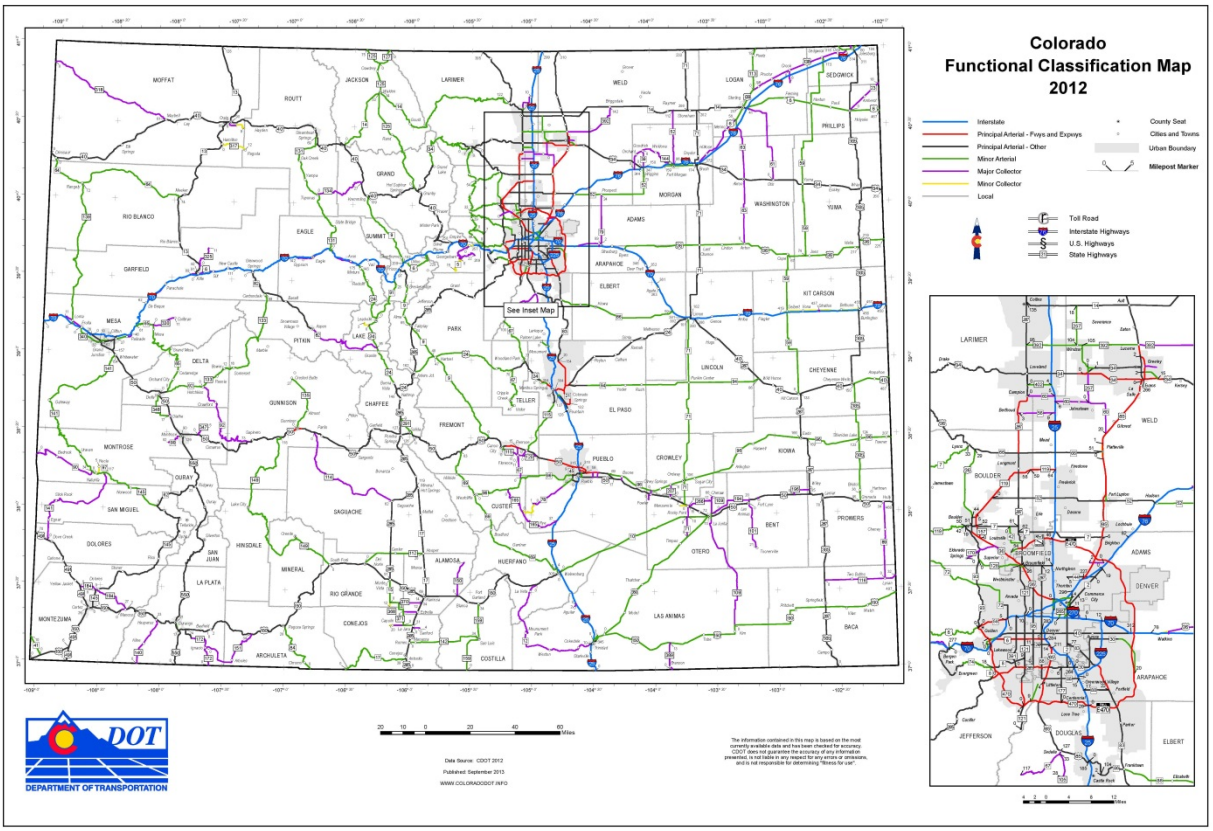


Figure 1. Functional Classification Map
http://dtdapps.coloradodot.info/staticdata/Downloads/StatewideMaps/func_class_pdf.pdf

Hot Mix Asphalt
High quality, thoroughly controlled hot mixture of AC (binder) and high quality aggregate, which can be compacted into a uniform mass, to act as a surface course and carry traffic. Stone Matrix Asphalt (SMA) and Polymer Modified Asphalt (PMA) are both types of HMA. In historic documents, HMA may also be referred to as Plant Mixed Bituminous Pavement and Hot Bituminous Pavement.

Longitudinal Cracking
Cracks are parallel to the pavement centerline or laydown direction.

Major Collector
A road of the intermediate functional category that collects traffic from the local roads to arterials or distributes traffic to local roads from arterials.

Minor Arterial
A highway primarily for through traffic, usually on a continuous route with less traffic than a principal arterial.

IRI
The International Roughness Index is the obtained from measured longitudinal road profiles to evaluate the pavement's smoothness and to identify specific locations where repairs or improvements are needed.

Maintenance
The preservation of the entire roadway, including surface, shoulders, roadsides, structures, and such traffic control devices as are necessary for its safe and efficient utilization.

M-E Design
AASHTOWare Pavement M-E Design software uses the methodology and pavement design models described in the AASHTO Interim Mechanistic-Empirical Pavement Design Guide Manual of Practice for pavement design and analysis.

Pavement Management
Pavement management is the evaluation, documentation, and analysis of the amount, quality and type of pavement under the responsibility of any given owner or agency. It is also the planning and budgeting for the upkeep and replacement of paved assets.

Pavement Performance
The trend of serviceability with load applications.

Pavement Rehabilitation
Work undertaken to extend the service life of an existing facility. This includes placement of additional surfacing material and/or completing any other work necessary to return an existing roadway, including shoulders, to a condition of structural or functional adequacy. This could include the complete removal and replacement of the pavement structure.

Performance Period
The period of time that the initially constructed or rehabilitated pavement structure will last (perform) before reaching its terminal serviceability. This is also called the design period.

Permanent Deformation
Longitudinal surface depressions in the wheel paths (also referred to as rutting).

Principal Arterial
A highway primarily for through traffic, usually on a continuous route.

Probabilistic Life Cycle Cost Analysis
A process where probabilistic LCCA inputs are described by probability functions that convey both the range of likely inputs and the likelihood of their occurrence. Probabilistic LCCA also allows for the simultaneous computation of differing assumptions for many different variables. Probabilistic LCCA allow the value of individual data inputs to be defined by a frequency (probability) distribution.

Remaining Service Life (RSL*)*
The remaining service life is the number of years a pavement is expected to last until maintenance and rehabilitation treatments no longer improve or maintain the surface condition.

Service Life
The service life is the number of years a pavement is expected to last from completion of construction until pavement failure.

Standard Normal Deviate (Z_R)
The standard normal deviate is a statistical value identical to Z-scale value used in the standard normal distribution. It is a measure of the deviation of any observations from the mean of all observations expressed in terms of the number of standard deviations. The standard normal deviate, Z can be calculated from the equation, Z = (observed value - mean of all observed values) / standard deviation of all observations. Each calculated Z value corresponds to a certain level of significance, confidence interval, certainty or reliability value in a standard normal distribution curve.

Structural Deficiency
Any condition that adversely affects the load carrying capability of the pavement structure. These include inadequate thickness as well as cracking, distortion, and disintegration. Several types of distress (i.e., distress was caused by poor construction techniques, low temperature cracking) are not initially caused by traffic loads, but do become more severe under traffic, to the point that they also detract from the load carrying capability of the pavement.

Surface Life
A period of time where treatments can be performed on a pavement that maintain or improve the surface condition.

Transverse Cracking
Cracks that are perpendicular to the pavement centerline or laydown direction (also referred to as thermal cracking).