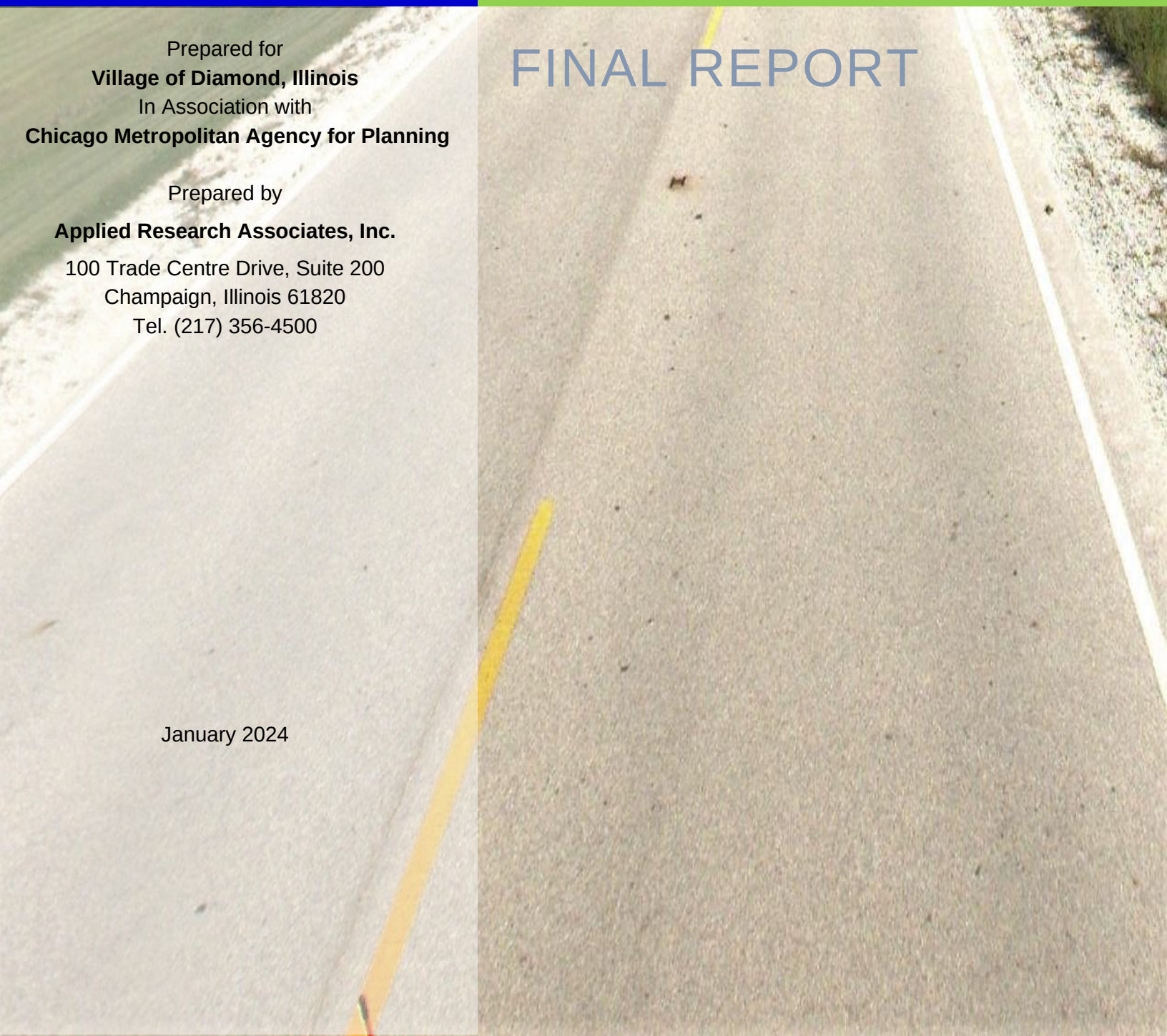
Pavement Data Collection and Pavement Management System Implementation for Village of Diamond, IL

FINAL REPORT



Prepared for
Village of Diamond, Illinois
In Association with
Chicago Metropolitan Agency for Planning

Prepared by

Applied Research Associates, Inc.
100 Trade Centre Drive, Suite 200
Champaign, Illinois 61820
Tel. (217) 356-4500

January 2024

Table of Contents

INTRODUCTION 3
1.1 Background 3
1.2 Project Kick-off and Records Review 3
1.3 Network Segmentation 3
1.4 Traffic Data 4
2. FIELD DATA COLLECTION AND ASSESSMENT 7
2.1 Digital Survey Vehicle (DSV) 7
2.2 Pavement Condition Index Procedure 8
2.3 Pavement Network and Current Condition 11
3. PAVEMENT MANAGEMENT SYSTEM (PMS) IMPLEMENTATION 15
3.1 PAVER™ Pavement Management System Overview 15
3.2 Pavement Performance Model 16
3.3 Treatment Matrix 17
3.4 Unit Costs 19
3.5 Annual Budget 19
4. MAINTENANCE AND REHABILITATION ANALYSIS 21
4.1 Funding Scenario Results (Major M&R only) 21
4.2 Consequence of Localized Distress Maintenance 26
4.3 Pavement Preservation Recommendations 26
5. SUMMARY AND RECOMMENDATION 28
5.1 Summary 28
5.2 Recommendations 28
5.2.1 Better utilization of available funds by performing timely repairs 28
5.2.2 Routine update of PAVER™ pavement management system 28
5.2.3 Routine pavement condition survey 29
6. PAVEMENT PRESERVATION 30
APPENDIX — A 37

List of Abbreviations

Abbreviation	Explanation
AADT -	Annual Average Daily Traffic
AC -	Asphalt Concrete
ADT -	Average Daily Traffic
AECOM -	The organization AECOM
ARA -	Applied Research Associates
ASTM -	American Society for Testing and Materials
CMAP -	Chicago Metropolitan Agency for Planning
DSV -	Digital Survey Vehicle
FHWA -	Federal Highway Administration
GIS -	Geographic Information System
GPS -	GLOBAL Positioning System
HMA -	Hot Mix Asphalt
IDOT -	Illinois Department of Transportation
IRI -	International Roughness Index
LCMS -	Laser Crack Measurement System
LTR -	Load Transfer Restoration
PCC -	Portland Cement Concrete
PCI -	Pavement Condition Index
PMS -	Pavement Management System
RSL -	Remaining Service Life
STA -	State Transportation Agencies

INTRODUCTION

1.1 Background

Chicago Metropolitan Agency for Planning (CMAP) selected the AECOM and Applied Research Associates Inc. (ARA) team, to develop pavement management plans for a selected number of local agencies from the CMAP region, including additional data collection for non-Federal Aid routes. Non-Federal aid routes are public roads that are not on the Federal-aid highway systems and classified as local roads or rural minor collectors. The pavement management plans will provide participating local agencies with a document that describes the importance and types of pavement preservation, the current condition of pavements, scenarios evaluating the cost to meet different network-level pavement conditions, and recommended capital plans based on the selected pavement condition/spending scenarios. The pavement management plan for the Village of Diamond, IL includes summary tables, charts, graphics, and maps depicting current pavement conditions and forecasted pavement conditions under different scenarios. CMAP and AECOM staff managed the development of the pavement management plan in conjunction with the Village of Diamond.

As part of this project, ARA has evaluated the current condition of the Village of Diamond's roadway pavement network, implemented a pavement management system (PMS) using PAVER™ software, forecasted condition, generated budget scenarios, and recommended future maintenance and rehabilitation (M&R) plans.

1.2 Project Kick-off and Records Review

ARA met with the Village of Diamond (the Village), CMAP, and AECOM representatives for a project kick-off meeting on July 25, 2023. Based on the kick-off meeting and documents provided by the Village and CMAP, pavement data was collected in August 2023. The GIS shapefile was provided by CMAP and was used as the base map for the field data collection. The network segmentation provided in the GIS shapefile was the primary source of roadway inventory for the Village's pavement management database. The Village responded with valuable information to a questionnaire provided by ARA, which was used to better understand the PMS inputs available from the Village and any specific project requirements. ARA worked with the Village to finalize treatment types, unit costs, and their annual budgets from 2024 through 2033 to plan future M&R activities. The following documents were reviewed as part of this effort:

- GIS shapefile for the local agency (Source: IDOT Centerline GIS shapefile)
- Network Segmentation for collection (Source: Village of Diamond)
- Review of network segmentation (Source: Village of Diamond)
- Completed Questionnaire (Source: Village of Diamond)

1.3 Network Segmentation

The Village of Diamond manages about 13.18 miles of roadway pavements, consisting of asphalt pavements. The initial GIS shapefile consisted of 92 segments, out of which 91 segments were inspected because one segment was inaccessible or non-existent.

1.4 Traffic Data

Figure 1 displays the distribution of network length based on functional class. As observed in Table 1, the majority of the roadway network is comprised of local/residential streets.

Figure 1. Village of Diamond's roadway network segmentation.

Collectors gather traffic from local roads and funnel it to the arterial network. Collectors serve primarily intra-county travel and typical travel distances are shorter than on arterial routes. Collectors are broken down into two categories: Major Collectors and Minor Collectors. Generally, major collector routes are

longer; have lower driveway densities; have higher speed limits; are spaced at greater intervals; have higher traffic volumes and may have more travel lanes than their minor collector counterparts.

The minimum spacing between two collector roadways in suburban areas of Illinois is ½ or 1 mile typically. In a densely populated urban area, two collector roadways might be found at ¼ mile spacing or less, but in most areas within the Chicago metropolitan region ¼ mile is considered an absolute minimum and requires significant justification in terms of the traffic patterns and land uses served. An exception is the case of paired one-way roads serving traffic moving in the opposite direction of each other. Projects on roadways with a minor collector functional classification and located outside of the adjusted urbanized area boundary are not eligible for federal-aid funding.

Local/residential roads primarily provide access to private properties and connect with higher classified routes. Design speeds are low, stub sections are common, and the main consideration is given to access needs. They offer the lowest level of mobility, have the shortest trip lengths, and through traffic are often deliberately discouraged. Local roads and streets are typically not eligible for federal-aid funding, though some bicycle and pedestrian projects on local roads and streets may be eligible for federal-aid funding.

Average daily traffic (ADT) data for the Village of Diamond network was obtained from the following two resources:

- Illinois Department of Transportation (IDOT) transportation management system: http://www.gettingaroundillinois.com/gai.htm?mt=aadt.
- IDOT Traffic Count Database Systems: https://idot.public.ms2soft.com/tcds/tsearch.asp?loc=Idot&mod=

The maximum traffic volume in the Village's network is 10,100 vehicles per day. Figure 2 shows the annual average daily traffic (AADT) data for the individual pavement sections.

Table 1. Village of Diamond's roadway network distribution.

Network/Functional Class	2023 AADT		Length (miles)
	Maximum	Minimum	
Arterial	10,100	9,750	1.01
Collector	1,300	1,300	0.99
Local/ Residential	19,00	325	11.18
		Total Network	13.18

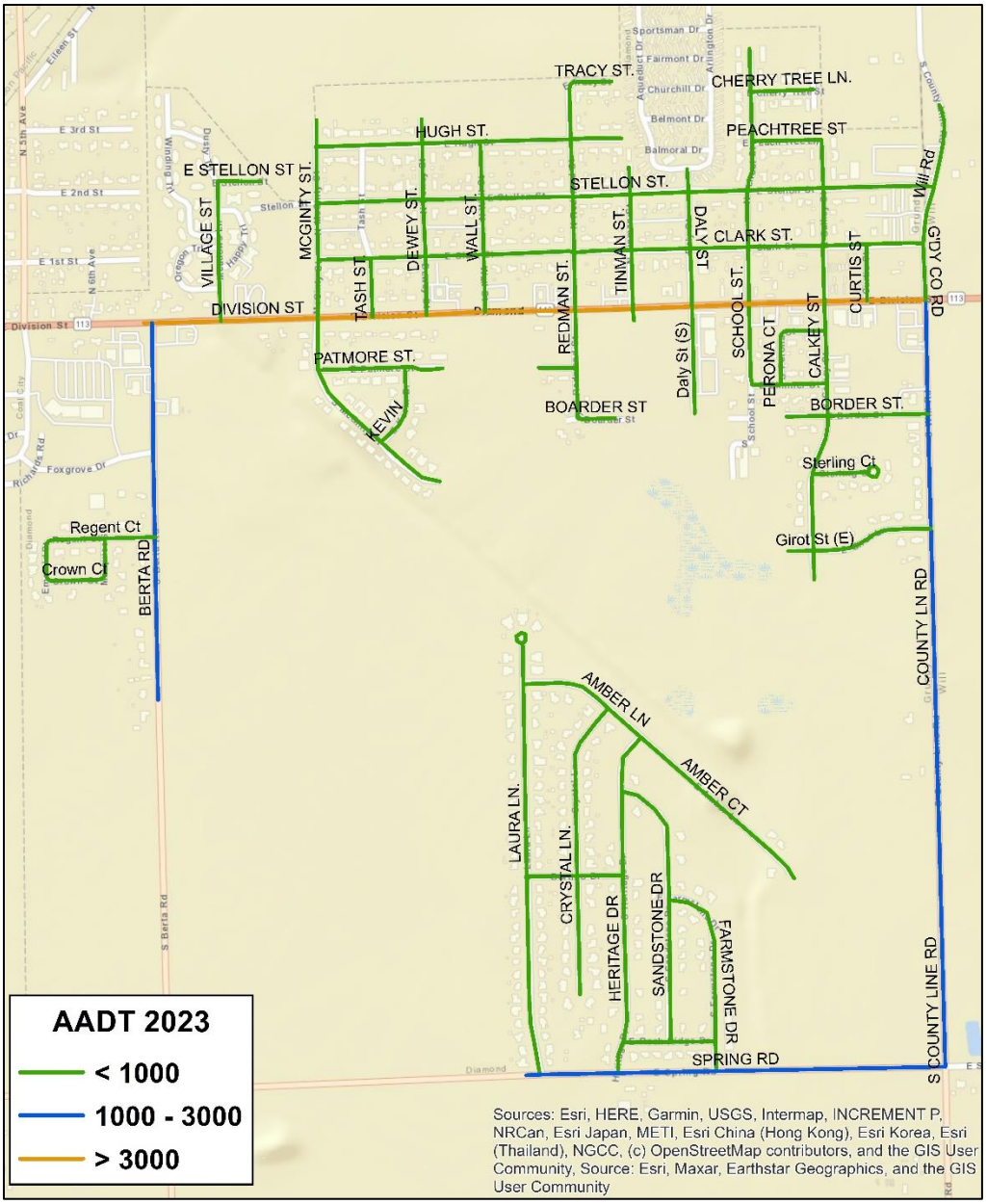


Figure 2. Village of Diamond's annual average daily traffic data.

2. FIELD DATA COLLECTION AND ASSESSMENT

2.1 Digital Survey Vehicle (DSV)

ARA collected geo-referenced images of the entire Village of Diamond roadway network using the DSV in August 2023. ARA's DSV equipped with the Laser Crack Measurement System (LCMS), shown in Figure 3, captures images at 20-ft intervals. Each image is linearly referenced with the DSV's onboard distance measuring instrument (DMI) and associated global positioning system (GPS) coordinates. For most of the sections ARA collected images in a single direction, except in case of four-lane pavement sections where data was collected in the outermost lane in both directions.

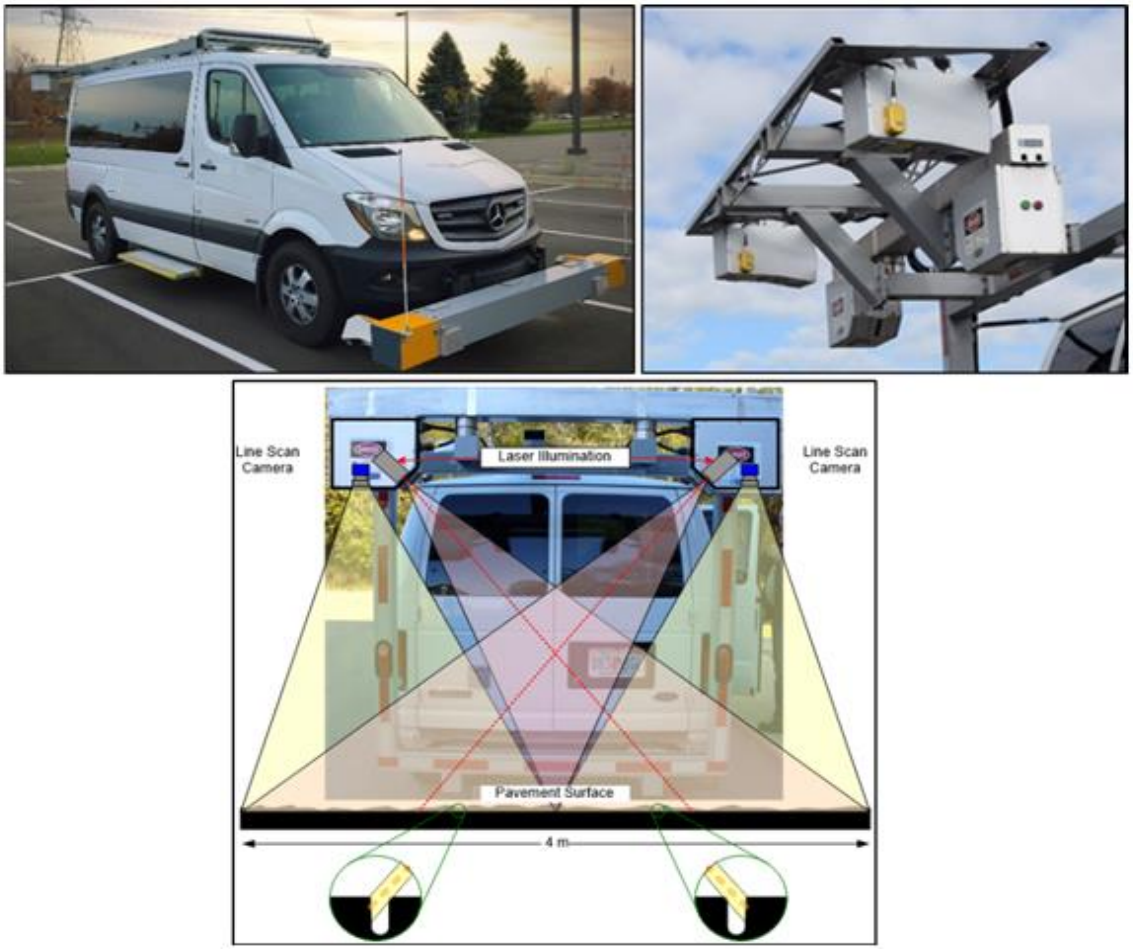


Figure 3. ARA's Laser Crack Measurement System (LCMS).

The LCMS captures enhanced right-of-way images using a right-of-way camera system. The images were used to assess the surface condition of pavements using the Pavement Condition Index (PCI) methodology per ASTM D6433. In addition to the images, International Roughness Index (IRI) and rutting information were collected using a high-speed laser profiling sensor for all the segments. The weighted average IRI value of the Village network is 284 inch/mile. Figure 4 illustrates the Federal Highway Administration (FHWA) condition scale as part of its Highway Performance Monitoring System (HPMS) requirements. The

HPMS requirements for roadway smoothness is relatively stringent because it represents networks that accommodate relatively speedy traffic.

IRI (in/mile)	Condition
0 – 200	Smooth
201 – 400	Marginal
Over 400	Rough

Figure 4: IRI scale based on FHWA's HPMS requirements.

However, pavement roughness is subjective to human perception. The level of tolerance of roadway roughness is relatively higher for urban-street travelers because of lower operating speed than Interstate and US highways. Moreover, urban street smoothness is largely impacted by frequently intersecting streets, and localized roughness (e.g., manhole covers, railroad crossings, bridge approaches, roundabouts, etc.). Many of these items are not existent in Interstate or US highways. To account for these variabilities in pavement roughness estimation, a study was conducted by the District Department of Transportation (DDOT). The study was focused on IRI values of dense urban roadways of Washington D.C. As part of the study, a survey was conducted asking D.C. travelers to give their opinions on pavement smoothness based on the Weaver/AASHTO scale. The ratings were directly used to establish a correlation between actual IRI value and perceived smoothness. The study proposed a new scale for the DDOT suggesting 188-318 in/mi for Collectors and 182-281 in/mi for Arterials as acceptable ranges.

2.2 Pavement Condition Index Procedure

Pavement Condition Index (PCI) is a measurement of pavement condition which ranges from 0 to 100. This is an industry-standard defined in ASTM D6433. A newly constructed pavement will have a PCI of 100 whereas a failed pavement will have a PCI of 10 or less. The typical PCI value vs pavement rating is shown in Figure 5. After construction, PCI starts to deteriorate with time due to traffic loads and volumes, climate, construction materials, and age. Examples of common traffic load-related distress are fatigue cracking, corner break, etc. whereas block cracking, longitudinal and transverse cracking, etc. are climate-related distresses.

PCI Value	Pavement Rating
100	
85	Good
70	Satisfactory
55	Fair
40	Poor
25	Very Poor
10	Serious
0	Failed

Figure 5. Pavement condition category based on the PCI value.

A PCI survey allows users to compare all pavements on a common scale and provides an index for monitoring pavement deterioration and treatment selection during the pavement management analysis. Typically, PCI surveys are conducted foot-on-ground in the field. ARA performed a modified PCI survey that allows the use of digital images to perform the survey in an office environment and still provides the highest detail of distress rating.

ARA's LCMS system identifies the pavement distresses and reports the type, severity, and extent of key pavement distresses, as shown in Figure 6. Some sample pavement surface images with representative PCI values are shown in Figure 7.

Ten percent of the surveyed sections were subjected to an internal quality assurance survey by an independent surveyor. After completion of the PCI calculation, visual checks were performed to ensure that the PCI values are representative of the surveyed images.

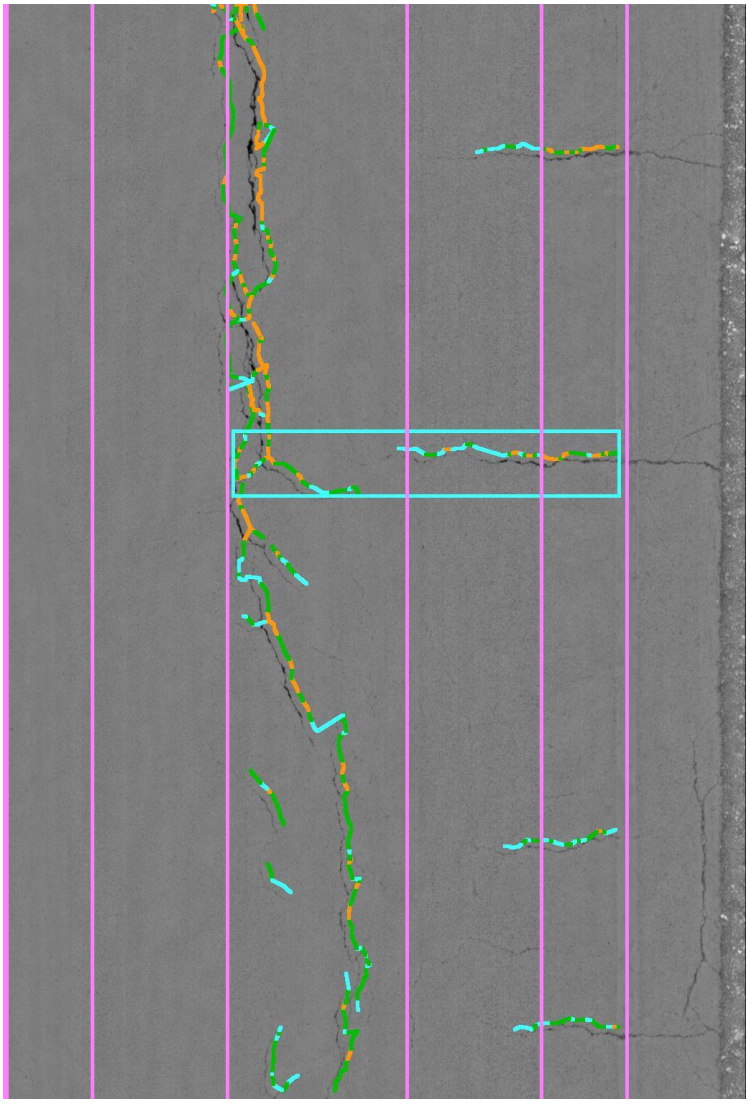


Figure 6. Pavement distress detection using LCMS system.

Figure 7. Sample pavement images with different PCI values ('Good' - 'Serious').

2.3 Pavement Network and Current Condition

After performing an automated condition survey with the collected images, the data was imported into the PAVER™ software. As mentioned earlier, one (01) section listed below was not inspected because it was inaccessible due to blocking of driveway.

- DIAMOND::COUNTYLN::450 - 0.02 mi

Based on the August 2023 pavement condition survey, the weighted average PCI of the network is 72.0, which represents a pavement network in "Satisfactory" condition. ARA discussed the results of the PCI survey on October 4, 2023. Table 2 shows the pavement condition, percent area, number of sections, and number of sections by pavement surface type.

Table 2. Pavement condition, percent area, and the number of sections by pavement surface type.

Surface Type	Wt. Avg PCI	Pavement Area (Sq. Ft.)	% Area	Number of Sections
Asphalt Concrete (AC)	72	1,718,672	≈ 100	91

Figure 8 shows the distribution of network pavement area based on current pavement conditions. Per the latest survey, 58% of the network is in "Satisfactory" or "Good" condition 58 whereas only 1% of the network is in "Serious" condition. There were no sections in "Failed" condition at the time of survey.

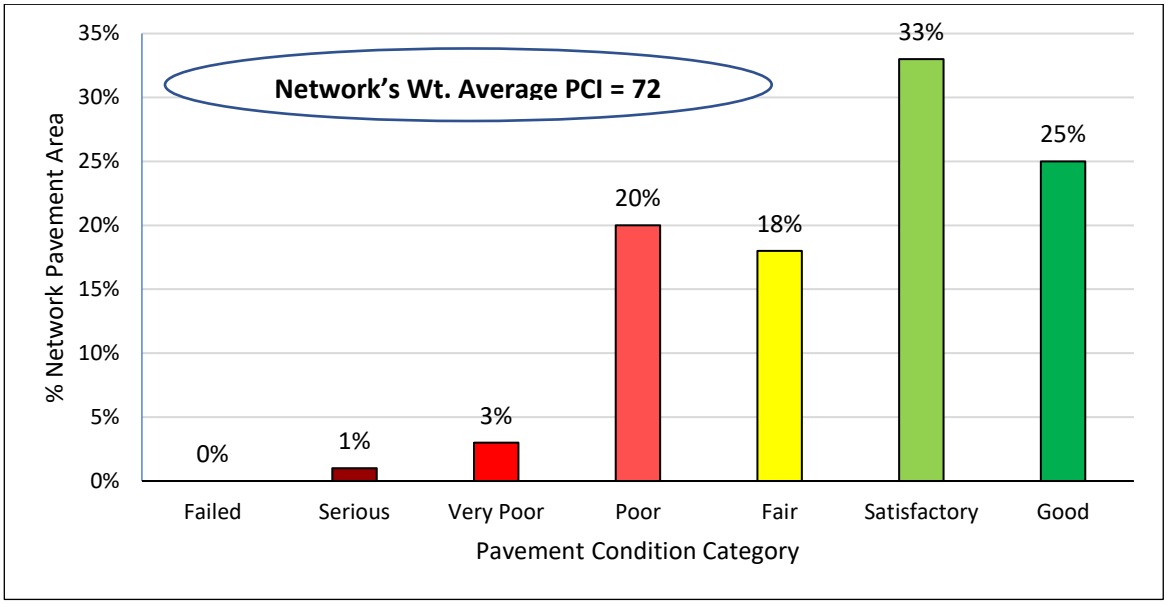


Figure 8. Distribution of network pavement area based on pavement condition.

Figure 9 shows detailed distributions of pavement conditions among various PCI bands based on functional class. All roads were found to be in "Good" condition in both arterial and collector functional classes, whereas most of the local roads were in "Satisfactory" or "Good" condition. Roads that are in the "Satisfactory" and "Fair" categories have the potential of profiting the most from a pavement management program. Collector roads have significantly greater "Poor" and "Very Poor" roads and fewer 'Satisfactory' roads compared to Residential roads.

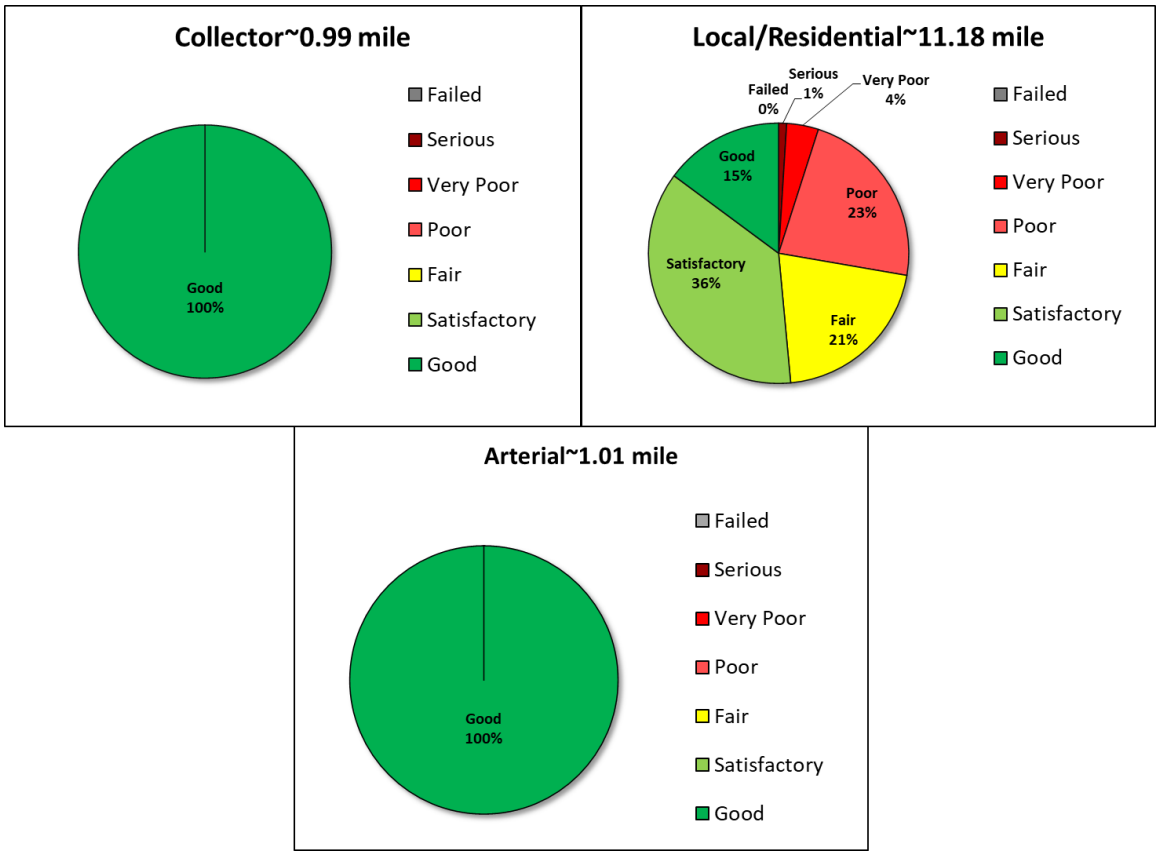


Figure 9. Pavement condition distribution based on functional class.

Figure 10 shows the average pavement condition based on functional class. The collector and arterial pavement sections comprise about 12% of the network by pavement mileage and are in "Good" condition with an average PCI value of 92 and 95, respectively. The major part (87% by pavement mileage) of the network consists of residential streets with an average PCI value of 69, which falls in the "Fair" band. The overall network PCI is influenced heavily by the residential road PCI scores since it has the largest weightage factor among the two functional classes. A GIS map with pavement conditions for individual segments is shown in Figure 11.

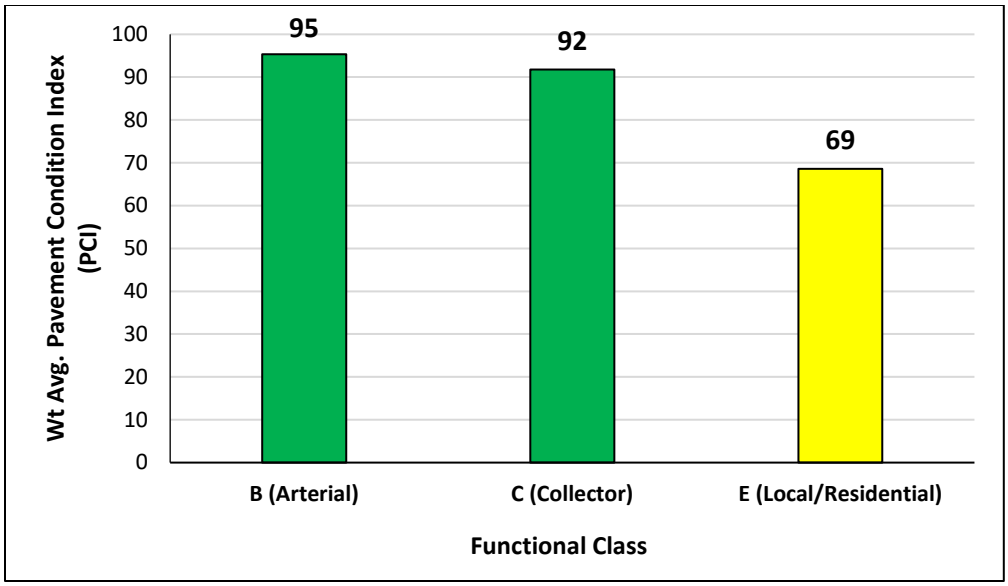


Figure 10. Average pavement condition index (PCI) based on functional class.

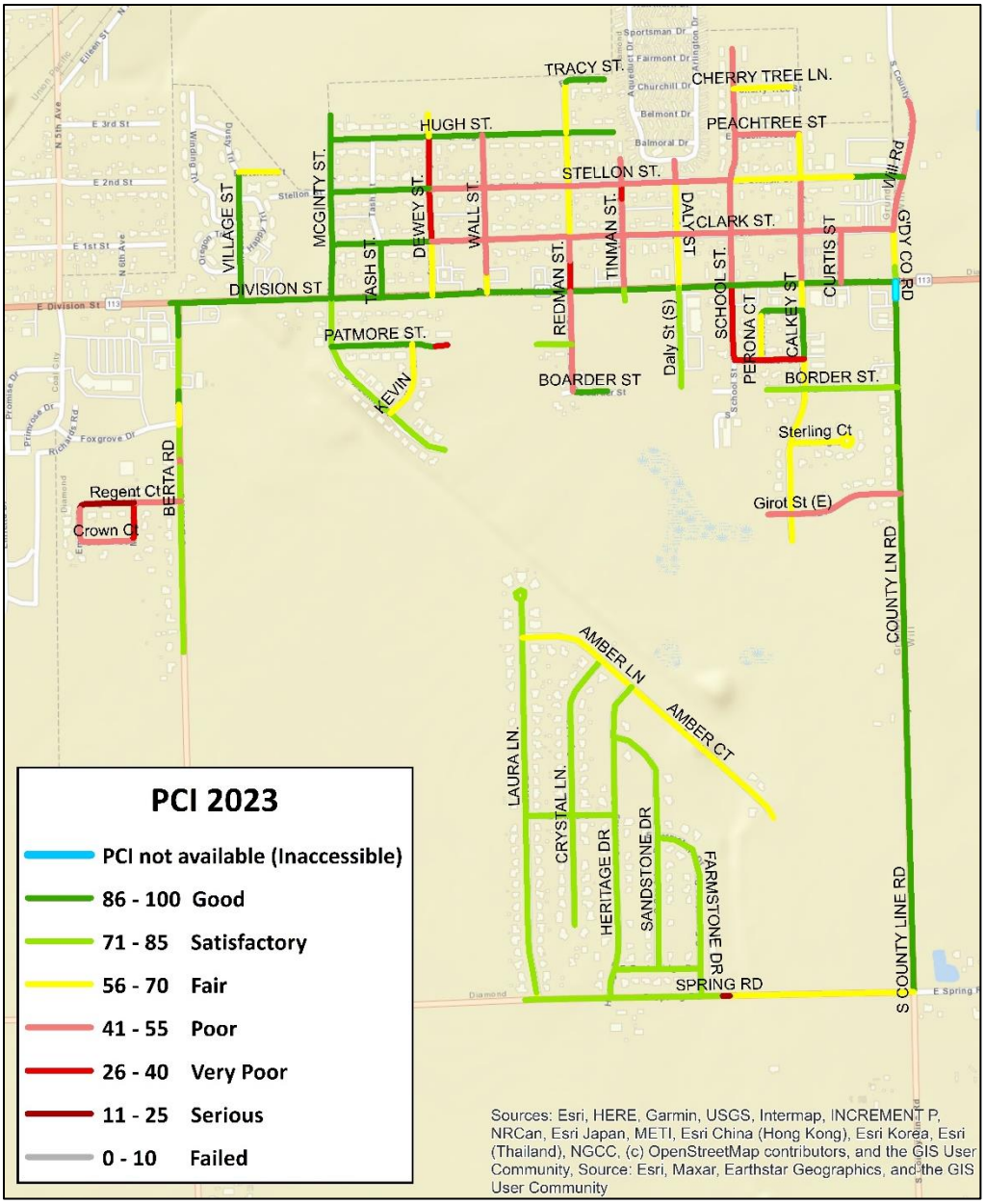


Figure 11. Village of Diamond's current pavement condition ratings.

3. PAVEMENT MANAGEMENT SYSTEM (PMS) IMPLEMENTATION

ARA discussed the PMS analysis results with the Village, CMAP, and AECOM on October 04, 2023. ARA discussed pavement performance models, treatment matrix, unit costs, and the consequences of several funding scenarios. ARA has prepared this report based on the Village's feedback on the PMS analysis. This section presents a detailed discussion of the analysis results.

ARA used PAVER™ pavement management software to implement a PMS for the Village of Diamond. PAVER™ provides pavement management capabilities to (a) develop and organize the pavement inventory, (b) assess the current condition of pavements, (c) develop models to predict future conditions, (d) report on past and future pavement performance, (e) develop scenarios for M&R based on budget or condition requirements, and (f) plan projects.

3.1 PAVER™ Pavement Management System Overview

Figure 12 shows the various modules of the PAVER™ software. Below is a list of terminologies related to this software:

- Inventory — The inventory module is designed based on a hierarchical structure including network, branch, and sections where a section is the smallest pavement unit managed by the agency. This structure allows users to easily organize their inventory while providing numerous fields and levels for storing pavement data.
- Work History — Similar to the inventory module, the work history module also follows the hierarchical structure. To update a pavement section's attribute or work history, it is required to have the network, branch, and section information.
- Inspection — In the inspection module, pavement can be surveyed manually, or the automated survey data can be imported and modified, and finally PCI is calculated.
- PCI Family Model— The PCI family model module is used to create a pavement performance model using historical pavement condition and age data.
- Condition Analysis — The condition analysis module is used to analyze or predict the condition of the entire or part of the network. This feature reports past conditions based on prior interpolated values between previous inspections and projected conditions based on prediction models.
- M&R Family Models — M&R Family Models module is used to select treatment, treatment consequences, unit costs, and treatment matrix.
- M&R Working Plans — M&R working plans module allows the user to create multi-year network and project level M&R planning, scheduling, and budgeting. This module allows the users to create a consequence of the current funding level and generates funding scenarios for targeted PCI, backlog eliminations, etc.
- Reports — This module facilitates the generation of summary charts, latest condition maps, and user-defined reports. The users can pick and choose the attributes fields to create a report.

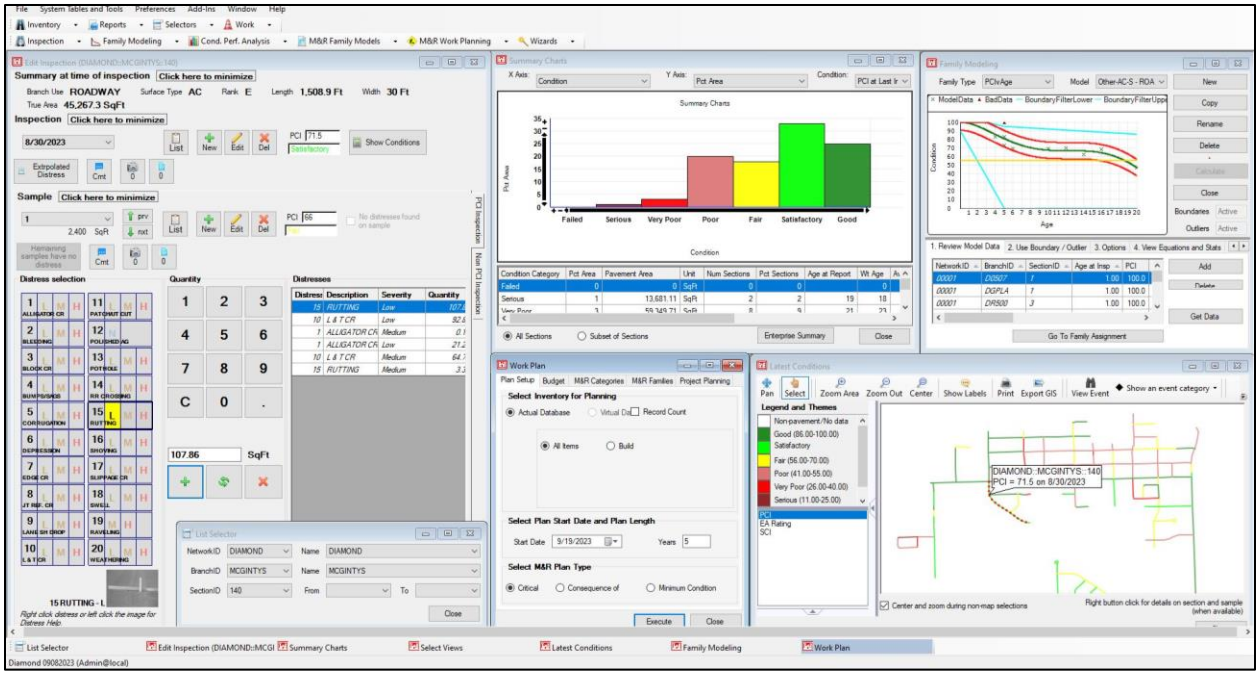


Figure 12. PAVER™ overview.

3.2 Pavement Performance Model

A PMS is only useful for making decisions if performance models can be established, validated, and relied upon to accurately forecast pavement conditions into the future. A pavement performance model is developed based on the date of construction for new pavement and the date of resurfacing for an overlay or mill and overlay, the types and thicknesses of pavement materials, the traffic level, and the pavement condition. The pavement performance model becomes more accurate with multiple pavement condition ratings, as the model gets calibrated and adjusted to match the conditions present at the time in a pavement's life cycle.

The PCI Family Models module in PAVER™ helps to identify and group pavements of similar construction that are subjected to similar traffic, weather, and other factors affecting pavement performance. The pavement condition historical data are used to build a model that can accurately predict the future performance of a group of pavements with similar attributes.

For the Village of Diamond, a PCI family model was developed for the asphalt (AC) surfaced pavements. The AC pavement performance model was developed based on the age data provided by the Village and the latest PCI conditions. The reliability of the model is expected to increase with future pavement inspection and age data. Figure 13 shows the PCI family model used for the AC pavements.

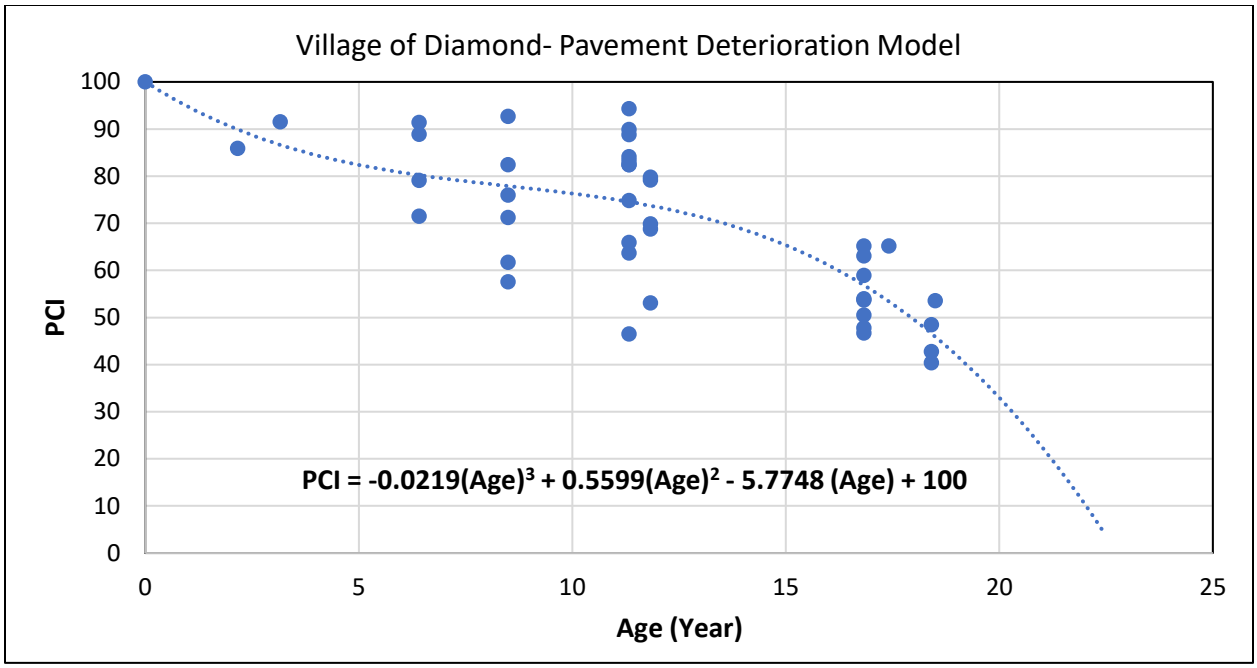


Figure 13. PCI family model for asphalt surfaced streets.

3.3 Treatment Matrix

Based on the pavement preservation and rehabilitation techniques currently used in the Village of Diamond, and discussion with the Village, ARA developed a treatment matrix that defines when a treatment will be performed based on PCI values and functional class of the pavement section. In PAVER™, critical PCI is defined as the PCI value at which the rate of PCI loss increases with time and the cost of applying localized preventive maintenance increases significantly. The M&R Family Assignment Tool is used to designate sections to receive specific M&R work, including:

- Localized Stopgap
- Localized Preventive, and
- Major M&R

The *Localized Stopgap* (PCI < Critical) option is used to indicate the use of Safety M&R policies, which allows PAVER™ to plan localized stopgap M&R work (pothole filling, etc.) on areas where the PCI is below the critical level. The *Localized Preventive* M&R (PCI >= Critical) option allows PAVER™ to plan M&R work in localized areas where the PCI is above critical. In this option, life-extending credit, in years, can be given to any localized preventive work. Application of any preventive work where PCI is still above critical will save money and improve pavement life. The *Major M&R* option allows PAVER™ to plan any overlay or other major work where the resulting pavement has a PCI of 100.

Table 3. Treatment matrix for the Village of Diamond's Local/Residential Roads (AC).

Treatment Matrix for Residential Roads				
PCI	**Localized Preventive**	**Localized Stop Gap**	**Pavement Preservation**	**Major M&R**
0 30	**No Localized Preventive Treatment Recommended**	**Patching and Repair**	**No Preservation Work Recommended**	**Full Reconstruction**
40				**3.0" Mill and Overlay**
70				**2.0" Mill & Overlay**
90	**Crack Seal and Distress Repair**	**No Localized Stop Gap/ Major M&R Recommended**	**Rejuvenator & Microsurfacing**	**No Major M&R Recommended**
100				

Table 4. Treatment matrix for the Village of Diamond's Collector/Arterial (AC) Roads.

Treatment Matrix for Collector/Arterial Roads				
PCI	**Localized Preventive**	**Localized Stop Gap**	**Pavement Preservation**	**Major M&R**
0 30	**No Localized Preventive Treatment Recommended**	**Patching and Repair**	**No Preservation Work Recommended**	**Full Reconstruction**
45				**4.0" Mill & Overlay**
70				**3.0" Mill & Overlay**
90	**Crack Seal and Distress Repair**	**No Localized Stop Gap/ Major M&R Recommended**	**Rejuvenator & Microsurfacing**	**No Major M&R Recommended**
100				

As observed in Table 3 and Table 4, Residential and collector pavement sections with PCI greater than 70 are selected for localized preventive treatments such as crack sealing or distress repair. These PCI values are the critical values set for pavements based on their levels of importance (Functional Class). Sections with PCI values falling below the critical PCI values are assigned to stopgap works such as patching and repair. The stopgap candidates are already eligible for major M&R work as long as funding is available. PAVER™ assigns major M&R works to a subset of the below-critical sections depending on the availability of funding. The 2-inch and 3-inch Mill and Overlays are considered for the Residential Roads below PCI of 70 and 40 respectively. The Collector/Arterial roads are set to receive 3-inch Mill and overlay earlier (as soon as the PCI drops below 70) and 4-inch Mill and Overlay below 45.

3.4 Unit Costs

ARA used the unit costs presented in Table 5 for developing different budget scenarios and a Capital Improvement Plan (CIP). Some of the costs were directly provided by the Village. Some of these costs were discussed with the Village during the PMS analysis results meeting on November 1, 2023. The Village reviewed and approved the unit costs. Costs were determined based on a square yard or linear foot basis. To run the PMS analysis in the future, the unit costs can be updated based on the available unit price of materials and construction.

Table 5. Treatment unit costs for the Village of Diamond.

Treatment Type	Unit Cost
Distress Repair & Crack Seal-AC	$ 1.50/ft.
2.00" Mill and Overlay-AC	$ 21.96/SY
3.00" Mill and Overlay-AC	$ 24.03/SY
4.00" Mill and Overlay-AC	$ 35.73/SY
Microsurfacing	$ 2.90/SY
Rejuvenator	$ 1.20/SY
Partial Depth Patching-AC	$ 30.00/SY
Full Depth Patching-AC	$ 60.00/SY
Reconstruction-AC	$ 99.00/SY

3.5 Annual Budget

Based on the information provided by the Village, an annual funding of $200, 0000 was utilized for analysis for a 10-year (2024-2033) period.

Per discussion with AECOM and the village, ARA allocated the annual budget for mostly Major M&R activities and for pavement preservation. The assumed budget allocation from 2024 to 2033 is shown below in Figure 14.

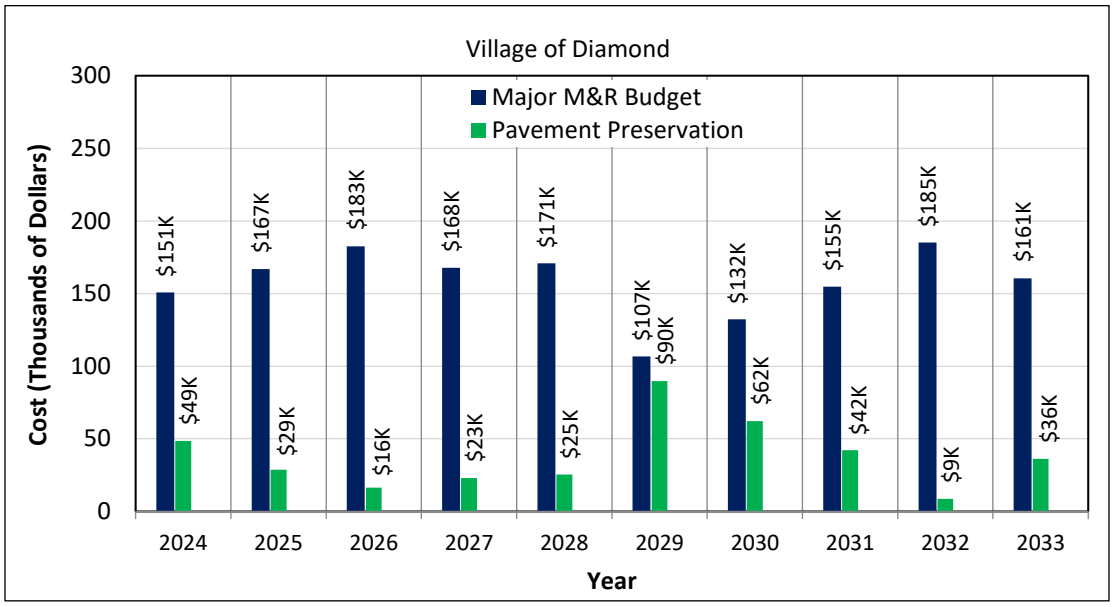


Figure 14. Assumed budget allocation for 10 years (2024-2033).

4. MAINTENANCE AND REHABILITATION ANALYSIS

Maintenance and rehabilitation (M&R) analysis can be performed in PAVER™ to generate an optimized work plan by assuming an annual funding level or by specifying a target PCI. For the Village of Diamond, the M&R funding analyses were based on the roadway inventory approved by the Village, unit costs discussed with the Village, and the Village's existing Major M&R policies. An inflation rate of 5% was used for all analyses. PCI family curves were developed based on existing pavement age and collected condition data. The critical PCI value was set to 70 for all roads (Residential, Collector, and Arterial). The critical PCI value represents the condition at or below which Major M&R is recommended. The following 10-year M&R funding scenarios were evaluated:

- Eliminate backlog
- Maintain current condition (PCI = 72)
- Keep funding level current (~$200K/year)
- Increase current funding level by 50%
- Do nothing

These 10-year scenarios represent different network-level funding scenarios of major M&R work either with a budget-driven or condition-driven goal. Budget-driven scenarios use a budget and distribute that over 10 years while the condition-driven scenarios run multiple iterations to achieve certain goals such as backlog elimination, achieving a target PCI, etc. In this prioritization process, PAVER™ selects projects that have the potential of resulting better benefit/cost ratio.

4.1 Funding Scenario Results (Major M&R only)

Using the M&R Working Plans module, different funding scenarios were generated. Based on the information provided by the Village, it was assumed that the current funding (Avg. $196K/year) would be spent on major M&R activities.

Table 6 and Figure 15 display the effect of different funding levels on the average pavement condition of the Village network. From Table 6 and Figure 15, it can be observed that the current M&R funding level is less than what is required for maintaining the current condition over next ten years. Providing a budget to eliminate backlog will result in an average PCI of 86 after ten years, while not spending any funds on the M&R program will deteriorate the network to an average PCI of 34 after ten years.

Table 6. Predicted PCI based on funding scenarios.

Year	$594K/year - Eliminate Backlog	$498K/year - Target PCI of 80	$410K/year - Maintain Current Condition	$296K/year - Increased Funding	$196K/year - Maintain Current Fund	$0/year - Do Nothing
2023	72	72	72	72	72	72
2024	77	76	75	74	73	70
2025	79	77	75	73	71	66
2026	80	77	74	71	68	61
2027	80	76	72	69	64	56
2028	81	76	71	66	61	51
2029	83	77	71	65	60	47
2030	84	78	72	65	59	43
2031	85	79	72	65	58	40
2032	85	79	72	64	56	37
2033	86	80	73	63	56	34

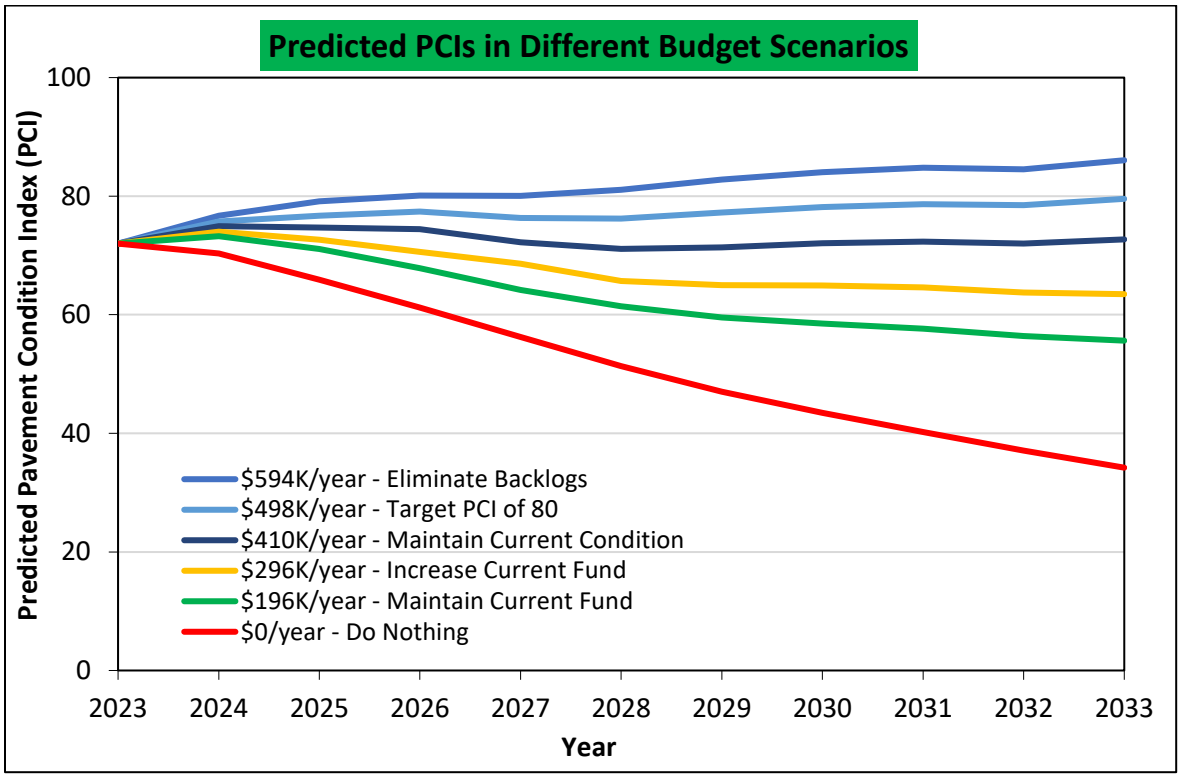


Figure 15. Effect of funding level on Village's pavement condition.

Table 7 and Figure 16 show the amount of funding required to achieve target PCI values for various funding scenarios. To eliminate backlog, it is required to invest about $594K/year for major M&R for ten years. This cost includes only pavement material costs and no other additional repair costs for sidewalks, curbs etc. or professional services costs related to construction such as planning, design, traffic control, etc. The

cost is only limited to the pavement (curb to curb) itself. Maintaining the current M&R funding (Avg. $196K/year) will result in a PCI of 56 by 2033.

Table 7. Total funded budget requirements per year based on funding scenarios.

Year	$594K/year - Eliminate Backlog	$498K/year - Target PCI of 80	$410K/year - Maintain Current Condition	$296K/year - Increased Funding	$196K/year - Maintain Current Fund	$0/year - Do Nothing
2024	$607,504	$501,184	$411,202	$298,525	$199,529	$0.00
2025	$602,604	$501,945	$413,841	$299,861	$195,784	$0.00
2026	$602,358	$494,925	$409,359	$296,913	$198,981	$0.00
2027	$596,759	$498,665	$412,360	$294,072	$190,635	$0.00
2028	$607,159	$500,449	$414,279	$293,757	$196,094	$0.00
2029	$605,572	$492,319	$399,749	$298,722	$196,505	$0.00
2030	$607,394	$499,785	$410,956	$287,107	$194,567	$0.00
2031	$597,021	$491,406	$414,396	$290,777	$196,787	$0.00
2032	$507,735	$502,965	$409,071	$297,847	$193,742	$0.00
2033	$603,430	$497,335	$407,644	$298,841	$196,701	$0.00

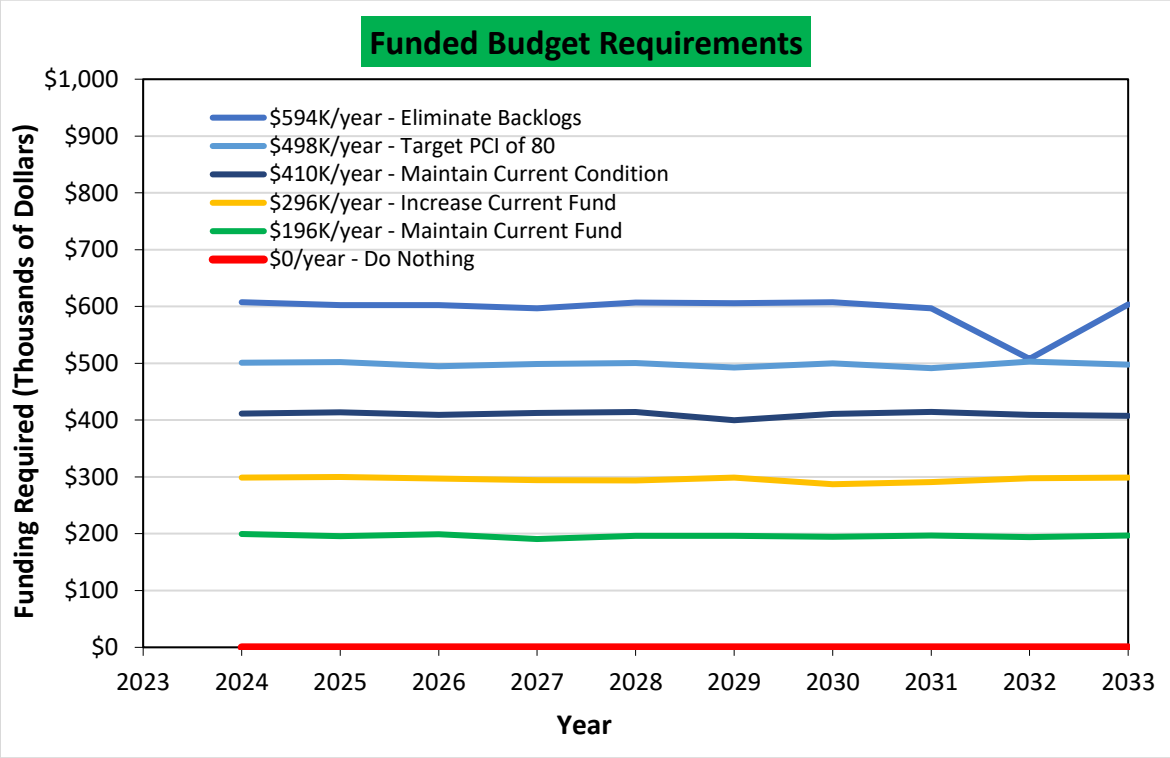


Figure 16. Total funded budget requirements per year based on funding scenarios.

Table 8 and Figure 17 show the total unfunded budget per year based on the funding scenarios. It can be seen that about $2M is required in 2024 to eliminate the backlog, while doing nothing will generate a backlog of $13.6M by 2033. Current major M&R funding will sustain a backlog of $7.7M by 2033.

Table 8. Total unfunded budget requirements per year based on funding scenarios.

Year	$594K/year - Eliminate Backlog	$498K/year - Target PCI of 80	$410K/year - Maintain Current Condition	$296K/year - Increased Funding	$196K/year - Maintain Current Fund	$0/yr Do Nothing
2024	$1,457,345	$1,563,665	$1,653,647	$1,766,324	$1,865,320	$2,064,849
2025	$1,661,859	$1,873,696	$2,056,738	$2,289,030	$2,496,595	$2,902,342
2026	$2,305,527	$2,636,154	$2,930,773	$3,277,849	$3,589,797	$4,228,016
2027	$1,997,297	$2,874,957	$3,853,023	$4,442,344	$4,916,276	$5,831,405
2028	$1,853,849	$2,866,816	$3,966,578	$5,173,011	$5,890,473	$7,035,653
2029	$1,465,650	$2,645,176	$3,886,116	$5,237,352	$6,610,699	$8,110,498
2030	$1,229,115	$2,571,854	$3,960,679	$5,516,776	$7,038,859	$9,608,482
2031	$762,451	$2,274,178	$3,806,459	$5,529,118	$7,236,151	$11,157,458
2032	$316,878	$1,904,192	$3,603,434	$5,519,972	$7,412,854	$12,038,035
2033	$0	$1,746,850	$3,598,901	$5,666,041	$7,732,267	$13,580,958

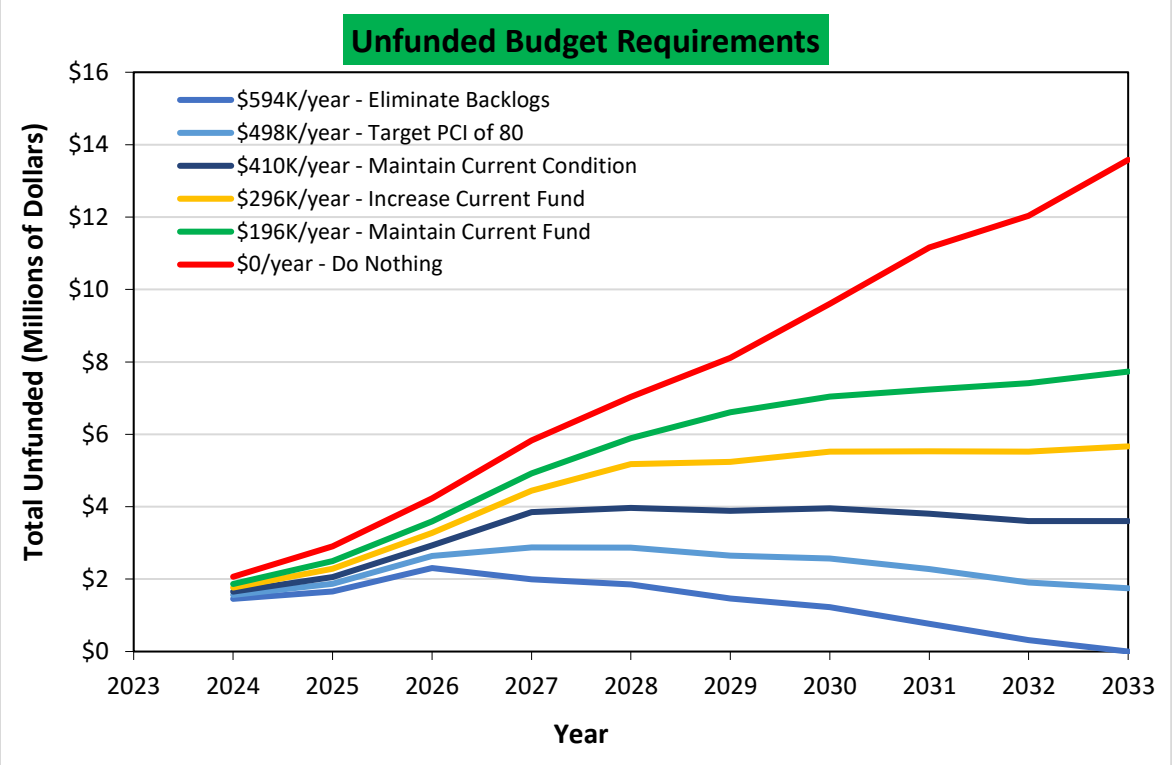


Figure 17. Total unfunded budget requirements per year based on funding scenarios.

The 10-Year major M&R plan based on the eliminate backlog, current funding, and 2024 localized distress maintenance plans are provided in Appendix A. Figure 18 shows the network condition distribution for

the next ten years with the current funding level. Currently, about 4% of the pavement network is in 'Very Poor' or worse condition. With current funding, the average PCI of the network is expected to be 56 in 2033; a decrease of 16 PCI points from the 2023 average PCI.

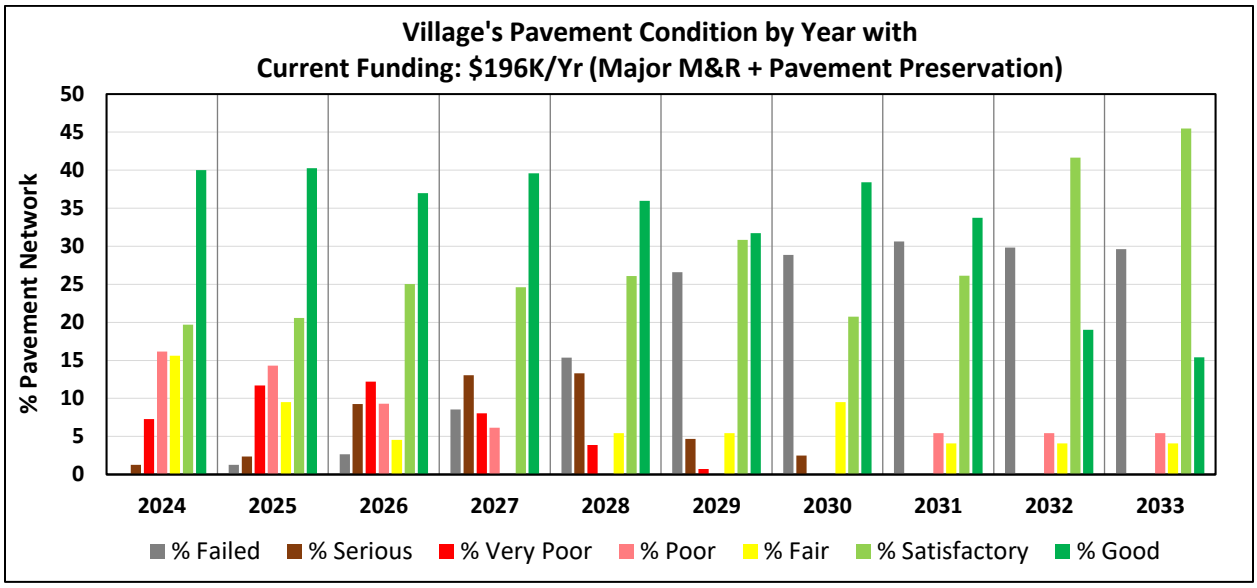


Figure 18. Pavement condition by year with current major M&R funding.

Based on the most recent inspection, about 76% of the network is "Fair" or better. However, the analysis suggests that if the provided M&R recommendations are followed, only about 65% (Figure 18) of the network will be in "Fair" or better condition by 2033 with the current funding (Avg. $196k/year). On the other hand, the "Failed" percentage will continue to increase by 30%. This is an approach to keep the better roads in better condition using the money available now and let the worse roads deteriorate until substantial funding is available. The cost of repair increases as the condition falls. Therefore, worse roads will cost more to fix whereas better roads will cost a fraction of that. Thus, more mileage of better quality is assured rather than few roads consuming the entire M&R budget. Table 9 presents the total ten-year costs for the funded projects and the remaining M&R backlogs in 2033.

Table 9. Total 10-Year Costs for Various Funding Scenarios (Millions of Dollars)

Funding Scenario	Total 10-Year M&R Costs (2024-2033)	Remaining M&R Backlogs in 2033	Total 10-Year Costs	Predicted PCI 2033
$594K/year - Eliminate Backlog	$5.9	$0.0	$5.9	86
$498K/year - Target PCI of 80	$5.0	$1.7	$6.7	80
$410K/year -Maintain Current Condition	$4.1	$3.6	$7.7	73
$296K/year - Increase Current Fund	$3.0	$5.7	$8.6	63
$196K/year - Maintain Current Fund	$2.0	$7.7	$9.7	56
$0/year - Do Nothing	$0.0	$13.6	$13.6	34

1. 'M&R Backlogs' refers to the amount required to resurface/reconstruct all pavements at or below their critical PCI value.
2. 'Total 10-Year Costs' refers to the sum of 10-year major M&R expenses and remaining backlogs at the end of 10-year period.
3. Current network weighted average PCI is 72.0.

4.2 Consequence of Localized Distress Maintenance

The consequence of a localized distress maintenance plan calculates the cost and resulting condition of immediate implementation of local M&R, for the year of the most recent inspection. Based on the 2023 pavement condition survey, the localized preventive plan estimates that 34 sections are eligible to benefit from an investment of $22,334 leading to an increase in PCI by 3.0 points. Similarly, the localized stopgap plan estimates that the PCI of 14 sections would increase by 2.0 points with an investment of $1,116. The details of the localized distress maintenance plan based on the 2023 condition survey can be found in Appendix A. Table 10 shows the cost and pavement condition data resulting from the consequence of localized distress maintenance plan. Table 11 shows the details of the local distress maintenance plan for 2024.

Table 10. Details of the consequence of local distress maintenance plan

Number Sections	Policy Cost	Wt. Avg. of PCI before Maintenance	Wt. Avg. of PCI after Maintenance
34 (Localized Preventive)	$22,334	84	87
14 (Localized Stopgap)	$1,116	51	53

Table 11. Details of the local distress maintenance plan 2024

Work Description	Work Quantity	Work Units	Work Cost
Crack Sealing (AC)	4,126	Feet	$6,189
Shallow Patching (AC)	635	Square Feet	$2,115
Deep Patching (AC)	2,271	Square Feet	$15,146
		Total =	$23,450

4.3 Pavement Preservation Recommendations

Pavement preservation considers all work types that are applied over a larger pavement area. The Global M&R table in PAVER™ allows a user to set the application interval for certain treatments and the age credits received as a result. This change is the time (in years) it would take for the condition of the pavement to return to where it was before the application of the preservation treatment. Pavement preservation can be applied on pavements with minimal distresses. The PCI range used for Microsurfacing application and Rejuvenation were 70-80 and 80-90, respectively. PAVER™-based recommendation on the budgeted pavement preservation dollars per year was allocated to each of the treatments.

Table 12 and Table 13 list the suggested years, PCI improvement, and cost of pavement preservation jobs for ten (10) years from 2024 to 2033 based on current funding. A map and a list of selected sections for each of the preservation treatments has been included in Appendix A for.

Table 12. Details of Microsurfacing plan (2024-2033)

Year	Treatment Type	PCI Before	PCI After	Cost
2024	Surface Treatment - Microsurfacing	77	81	$7,346
2029	Surface Treatment - Microsurfacing	78	82	$40,690
2031	Surface Treatment - Microsurfacing	79	83	$747

Table 13. Details of Rejuvenation plan (2024-2033)

Year	Treatment Type	PCI Before	PCI After	Cost
2024	Surface Seal - Rejuvenating	84	93	$41,323
2025	Surface Seal - Rejuvenating	89	100	$28,834
2026	Surface Seal - Rejuvenating	88	100	$16,386
2027	Surface Seal - Rejuvenating	87	100	$22,907
2028	Surface Seal - Rejuvenating	87	100	$25,350
2029	Surface Seal - Rejuvenating	84	94	$49,151
2030	Surface Seal - Rejuvenating	83	93	$62,269
2031	Surface Seal - Rejuvenating	84	94	$41,390
2032	Surface Seal - Rejuvenating	84	95	$8,638
2033	Surface Seal - Rejuvenating	82	92	$36,143

5. SUMMARY AND RECOMMENDATION

5.1 Summary

Pavement management can be defined as the systematic process of maintaining pavements cost-effectively. The investment in pavement management system is rational considering pavement management not only provides a consistent and rational management method to make decisions but also helps in optimal use of funds and reduces pavement rehabilitation, which results in extended pavement life and increased credibility with stakeholders.

In this effort to implement a pavement management system for the Village of Diamond, pavement data was collected with a state-of-the-art digital survey vehicle equipped with a laser crack measurement system. Pavement images were used in an automated condition survey process to assess the type, severity, and extent of the distresses. The pavement inspection data was imported to the PAVER™ software to determine the pavement condition index (PCI) and analyze the pavement network. This PAVER database provides a comprehensive inventory of pavement sections with all attributes that are required for pavement management.

Based on the August 2023 survey, the average pavement condition index (PCI) value for the Village is about 72.0, which indicates the pavement network is in overall "Satisfactory" condition. Based on the Village's recommendation, several ten-year M&R funding analyses were performed using PAVER™ including (a) do nothing ($0/year), (b) keep funding level current ($196K/year), (c) increase the current funding by 50% ($296K/year), (d) maintain current condition, (e) reach a target PCI of 80, and (f) eliminate backlog.

It was found that the Village's existing funding level is inadequate to maintain the current pavement condition level for the next ten years. Pavement treatments are less expensive as well as more rewarding when the condition is still better. As soon as the condition starts to deteriorate further, required treatments become costlier and less rewarding in terms of PCI improvement.

5.2 Recommendations

5.2.1 Better utilization of available funds by performing timely repairs

Currently, 4% of the pavement area is in "Very Poor" or "Serious" condition and 20% area is in "Poor" condition. The backlog is expected to increase every year with the current level of funding. It was determined that about Avg. $410K/year of funding is needed to maintain the current condition of the pavement network. It is recommended that the Village should focus on applying routine preventive maintenance to the pavement sections in "Satisfactory" and "Good" condition. Preventive maintenance activities, such as crack sealing and localized patching, can cost-effectively extend the life of a pavement.

5.2.2 Routine update of PAVER™ pavement management system

ARA recommends updating the PAVER pavement management system annually to record the major M&R, stopgap and localized preventive maintenance activities, and pavement inventory changes (i.e., section

split, new roads, jurisdictional changes, etc.). Based on the yearly updates of M&R activities, the Village can perform M&R analysis with an updated funding level (if available), accounting for the previous year(s) actual projects.

5.2.3 Routine pavement condition survey

For the Village of Diamond, it is an excellent initiative to establish a pavement management system with the cooperation of the Chicago Metropolitan Agency for Planning (CMAP). To realize the greatest benefit from this holistic effort, it is recommended that the Village continue to perform pavement condition surveys on a three to four-year cycle. The benefits of performing routine PCI surveys are many-folded, including:

(a) A survey provides the current condition of the pavement network and helps determine the effectiveness of completed M&R activities performed in the last few years,
(b) Pavement performance models would be more accurate to predict the future condition, and
(c) Appropriate treatment and optimal funding allocation are possible to repair localized distresses based on the survey.

The most recent PAVER™ analysis provides the Village with necessary information based on the latest pavement condition inspection. The Village can make more informed decisions with the data provided as well as make necessary changes to the strategy towards maintaining a better performing pavement network. PAVER™ analysis is a combination of several objectively gathered information such as pavement condition, functional class, traffic, etc. The analysis results provide an additional tool in the “tool-belt” to consider along with the many other factors that impact project-level decisions. The recommendations provided by PAVER™ are not absolute in nature. These recommendations can be considered as suggestions and final action plans should be made with proper engineering judgements and agency goals.

6. PAVEMENT PRESERVATION

Pavement preservation is a proactive method to keep pavements in good condition with lower costs. This approach includes work that is planned and performed to improve or retain the condition of the pavement in a state of good repair. The various pavement preservation techniques used in the state are also available in the local roads and streets manual (*https://idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Split/Local-Roads-and-Streets/Chapter%2045.pdf*) of IDOT. Preservation activities generally do not increase the structural strength but do restore pavements' overall condition. The intended purpose of a pavement preservation program is to maintain or restore the surface characteristics of pavements and to extend service life of the pavements being managed. However, the improvements are such that there is no increase in strength, but they can have a positive impact on the structural capacity by slowing deterioration. The Federal Highway Administration (FHWA) Office of Asset Management provided the following guidance regarding pavement preservation definitions in a memorandum dated September 12, 2005:

- Pavement preservation represents a proactive approach to maintain our existing highways. It enables State Transportation agencies (STAs) to reduce costly, time-consuming rehabilitation and reconstruction projects and the associated traffic disruptions. With timely preservation, we can provide the traveling public with improved safety and mobility, reduced congestion, and smoother, longer-lasting pavements. This is the true goal of pavement preservation, a goal in which the FHWA, through its partnership with the States, local agencies, industry organizations, and other interested stakeholders, is committed to achieving.
- The main component of pavement preservation is preventive maintenance. As defined by FHWA, preventive maintenance is a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity). The general philosophy of the use of preventive maintenance treatments is to “apply the right treatment, to the right pavement, at the right time.” These practices result in an outcome of “keeping good roads in good condition.”
- When activities (e.g., crack sealing, filling, application of seal coats) are placed on the pavement at the right time they are examples of preventive maintenance treatments. Preventive maintenance should be applied to pavements in good condition having significant remaining service life (RSL). It applies cost-effective treatments to the surface or near-surface of structurally sound pavements. Examples include the following:
  - Crack sealing
  - Patching (Partial and Full depth)
  - Rejuvenator/ Reclamite
  - Microsurfacing
  - Concrete Diamond Grinding

- Based on the pavement condition assessment results the following treatment options have been selected and described in this section:
  - Bituminous-Surfaced Pavements

- Asphalt Rejuvenator i.e., reclamite
  - This treatment can be applied globally in the Village of Diamond network at the very early stage of newly constructed pavement or after placing a new surface.
- Crack Filling/Crack Sealing
  - Sealing/filling cracks in asphalt and pavement prevent the intrusion of water into the pavement structure and decrease the deterioration of pavement conditions.
- Microsurfacing
  - This treatment can be applied to pavements having relatively higher PCI and minimal distresses.
- Patching
  - Asphalt patches are used for treating localized distresses from worsening.

- Concrete-Surfaced Pavements
  - Joint/Crack Sealing
    - Cracking sealing in concrete pavement prevents the entry of water beneath the concrete slab and helps to prevent pumping.
  - Concrete Diamond Grinding
    - Diamond grinding can be used for addressing concrete faulting ad surface irregularities so that a smooth riding surface is restored.
  - Patching
    - Concrete patching can be used to treat individual slab distresses or joint distresses such as spalling.

Table 14. Treatments on Bituminous-Surfaced Pavements: Crack Filling/Sealing.

AC - Crack Filling and Crack Sealing	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
These treatments are intended primarily to prevent the intrusion of moisture through existing cracks. Crack sealing refers to a sealant operation that addresses "working" cracks, i.e., those that open and close with changes in temperature. It typically implies high-quality materials and good preparation. Crack filling is for cracks that undergo little movement. Sealants used are typically thermo-plastic (bituminous) materials that soften upon heating and harden upon cooling.	Treatment can perform well in all climatic conditions. However, sealants perform best in the dryer and warmer environments that do not undergo large daily temperature changes.	Performance is not significantly affected by varying ADT or truck levels.	**Functional/Other:** • Longitudinal cracking • Minor block cracking • Transverse cracking **Structural:** Adds no structural benefit but does reduce moisture infiltration through cracks. Only practical if the extent of cracking is minimal and if there is little to no structural cracking.	• Structural failure (i.e., extensive fatigue cracking or high severity rutting) • Extensive pavement deterioration, little remaining life
Construction Considerations	Placement should be done during cool, dry weather conditions. Proper crack cleaning is essential to a good bond and maximum performance. Some agencies also use hot compressed air lance prior to sealing.			
Expected Life	2 to 6 years.			
Typical Costs	$0.30 to $1.50 per linear ft for crack sealing, including routing; $0.30 per linear ft for crack filling. Costs are slightly higher for small jobs.			

Table 15. Treatments on Concrete-Surfaced Pavements: Crack Sealing & Joint Resealing.

PCC - Joint Resealing and Crack Sealing	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
Resealing of transverse joints and sealing of cracks in PCC pavements is intended to minimize the infiltration of surface water into the underlying pavement structure and to prevent the intrusion of incompressibles into the joint. A range of materials including bituminous, silicone, and neoprene are used in designed configurations.	The sealing of PCC pavement joints and cracks performs well in all climatic conditions. Sealant performance is affected by environmental conditions and the performance of sealed and unsealed pavement structures probably varies within environmental regions.	• Performance is not affected by different ADT or percent trucks. • Silicone sealants that are not properly recessed are more likely to fail in the wheel path.	**Functional/Other** ongitudinal and transverse racking (L) nsealed or partially sealed oints. **Structural** No direct structural benefit but may reduce the rate of structural deterioration. Crack sealing is not an effective method of repairing cracked slabs but may be useful in preventing further deterioration.	Different materials can be expected to perform for different durations. Material selection should be based on the expected time until the next treatment.
Site Restrictions	The sealant reservoir should be clean and dry. Variable width reservoirs may cause a problem where backer rods are specified.			
Construction Considerations	Sealant performance is dependent on many construction factors, including material type and placement geometry, and application in a clean and dry environment.			
Expected Life	7 to 8 years.			
Typical Costs	$0.75 to $1.25 per linear ft for hot-pour rubberized materials and from about $1.00 to $2.00 per linear ft for silicone materials.			

Table 16. Asphalt Patching Treatment for Localized Distress.

Asphalt Patching	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
Asphalt Patches are common method of treating localized distress. HMA patches can either be Full-depth or partial-depth. Full-depth patches are necessary where the entire depth of pavement is distressed. Partial-depth patches are necessary where the distress is only limited to the pavement surface	Preferably during dryer and warmer months. Cold patches can be used for temporary pothole fixes.	Traffic control is needed. Reduced roadway capacity should be evaluated. Traffic can return to a patched pavement once it cools off to 140^0F	**Partial Depth Repairs** • Shallow potholes • Weathering and raveling • Block cracking **Full Depth Repairs** • Depressions • Pumping • Bottom-up fatigue cracking (thin pavement structure) • Underlying stripping	• Thermal cracking • Extensive pavement deterioration, little or no remaining life
Site Restrictions	Appropriate traffic control			
Construction Considerations	• Patch boundary should be clearly defined • Remove distressed materials and repair saturated subgrade soil or correct the main cause of distress • Repair should extend 12 inches into the non-distressed pavement • Apply tack coat on all the vertical and horizontal surfaces before placing the patch and compact the patch. • Compact quickly after placing the patch to ensure maximum compaction • Avoiding vibratory compaction under 175^0F • Maximum lift thickness is 3 inches. • Avoid leaving a thin strip of asphalt pavement (less than 18 inches wide) along the pavement edge. It is better to extend the repair to the pavement edge. • For small patches, use a jackhammer with a spade bit or a masonry saw. Make vertical cuts through the full depth of the asphalt pavement surface. If a jackhammer is used, work from the center of the patch area outward to avoid damaging good pavement. • For medium to large patches, use a diamond-bladed saw to cut the edges. If the distress is only at the surface and the pavement is thick enough, consider a partial depth cut for thick asphalt pavement surfaces to retain some interlock with the remaining structure.			
Expected Life	A provisional maintenance before major M&R. A patch itself can last longer without increasing the overall life of an entire pavement section. Therefore, the expected life should be evaluated on a case-by-case basis.			
Typical Costs	• AC Patch –Partial Depth - $20.00-25.00/SY • AC Patch –Full depth - $40.00-50.00/SY			

Table 17. Concrete Patching Treatment for Localized Distress.

Concrete Patching	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
Full-depth repairs are effective at correcting slab distress that extend beyond one-third the pavement depth such as longitudinal and transverse cracking, corner breaks, and joint spalling. Partial-depth repairs are primarily used to correct joint spalling. They can also be used to correct localized areas of distress that are limited to the upper 1/3 of the slab thickness.	Preferably during dryer seasons	High early strength concretes are used in cases where it is not desirable to close a lane overnight. Partial Depth Repairs are suitable under all traffic conditions.	<u>Full Depth Repairs</u> Localized distresses and to prepare distressed PCC pavements for a structural overlay to avoid premature failure of the overlay. <u>Partial Depth Repairs</u> To correct joint spalling caused by the intrusion of incompressible materials into the joints, localized areas of scaling, weak concrete, clay balls, or high steel, and the use of joint inserts.	• Widespread deterioration • Structurally deficient pavement. • Nearing the end of its fatigue life
Site Restrictions	None			
Construction Considerations	<u>Full Depth Repair</u> During construction, it is very important to properly prepare the base, restore joint load-transfer, and finish, texture, and cure the new material per governing specifications. <u>Partial Depth Repair</u> During construction, it is very important to properly determine repair boundaries, prepare the patch area, and finish, texture, and cure the new material per governing specifications. If distress is found to extend below the upper 1/3 of the slab, or if steel is exposed, a full-depth repair is required. Partial-depth patches should be a minimum of 4 in (10 cm) by 12 in (30 m).			
Expected Life	5 to 15 years			
Typical Costs	• PCC Patch –Full Depth - $225/SY • PCC Patch –Partial depth - $63/SY			

Table 18. Pavement Preservation Treatment: Asphalt Rejuvenator/Reclamite.

Asphalt Rejuvenator/Reclamite	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
According to the National Center for Pavement Preservation, "a true asphalt rejuvenator is a maltene-based petroleum product which has the ability to absorb or penetrate into an asphaltic concrete pavement and restore those reactive components (maltenes) that have been lost from the asphalt cement binder due to the natural process of oxidation. Reclamite is an asphalt pavement rejuvenator which is a maltene-based petroleum product.	• shall not be applied to a wet surface or when rain is occurring • shall not be applied when the temperature is less than 40° in the shade	Traffic control shall continue until the area has been sanded and the resultant surface is not slippery or dangerous to vehicular travel	Newly constructed pavements (0-3 years)	On older pavements, it will reverse the effects of aging due to reverse the effects of aging due to environmental damage from sunlight and environmental damage from sunlight and water intrusion.
Construction Considerations	All manufactured sand used during the treatment must be removed no later than 24 hours after the treatment of a roadway.			
Expected Life	Add 5 to 10 years of extra service life to the treated pavement			
Typical Costs	$0.94/Sq. Yd.			

Table 19. Pavement Preservation Treatment: Microsurfacing.

Microsurfacing	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
Microsurfacing is basically a slurry seal with an accelerated setting capability. It consists of the application of a mixture of water, asphalt emulsion, aggregate (very small crushed rock), and chemical additives to an existing asphalt concrete pavement surface. Polymer is commonly added to the asphalt emulsion to provide better mixture properties. The major difference between slurry seal and Microsurfacing is in how they "break" or harden.	• Not applicable during a rain event. • Not applicable in excessively cold temperature. • Atmospheric temperature is at least. 10^0C (50^0F) and rising. • Pavements that have a lot of shade.	• Applicable to high traffic situations. • Traffic can be allowed to roll when a person's full weight can be placed on the pavement without the aggregates sticking to the shoe.	• Low to Moderate level of distress. • Structurally sound pavement.	• Highly distressed pavement. • High longitudinal roughness. • Structurally deficient pavement. • Subgrade rut. • Ruts above 2-in deep.
Site Restrictions	Lane closure is needed.			
Construction Considerations	• Spread microsurfacing materials only when the atmospheric temperature is at least 10^0C (50^0F) and rising. • Thoroughly cleaned surface and slightly dampened prior placing the mixture. • Ruts deeper than ½-in shall be filled separately.			
Expected Life	6-8 years			
Typical Costs	$2.75/ yd^2			

Table 20. Concrete Pavements Repair: Concrete Diamond Grinding.

Concrete Diamond Grinding	Evaluation Factors			
	Climate	Traffic	Pavement Condition	Not Applicable To
Diamond grinding is effective at removing joint faulting and other surface irregularities to restore a smooth-riding surface and increase pavement surface friction.	Not recommended during excessively cold or hot temperature.	Grinding may be used to remove faulting. If the root cause is not addressed, faulting can reoccur due to the continued application of truck traffic. If used to restore friction to a polished pavement (due to vehicle traffic), heavy volumes of traffic may cause the problem to reoccur.	Note that diamond grinding is a surface repair method because it corrects the existing faulting and wear of PCC pavements. It does nothing to correct pavement distress mechanisms. Therefore, grinding usually is performed in combination with other rehabilitation methods to both repair certain pavement distresses and prevent their recurrence.	• High severity faulting. • Structurally deficient pavement. • Mid panel cracks or corner breaks. • Material related distresses. • Softer aggregate.
Site Restrictions	Moving Lane Closure is needed.			
Construction Considerations	Typically constructed with a moving lane closure with traffic operating in the adjacent lanes. Diamond grinding should be used in conjunction with all restoration techniques including load-transfer restoration, full- and partial depth repair, cross stitching, and subsealing/undersealing.			
Expected Life	8-15 years			
Typical Costs	$4.00/ft			

Appendix — A

1. 2024-2033 Major M&R Plan Based on Current Funding
2. 2024 Localized Distress Maintenance Plan
3. 2024-2033 Major M&R Plan Based on “Eliminate Backlog” Funding
4. 2024-2033 Global M&R Plan Based on Current Funding
5. Pavement Surface Type
6. 2023 Pavement Condition Index (PCI)
7. 2023 International Roughness Index (IRI)
8. List of Sections Selected for 2024-2033 Major M&R Plan Based on Current Funding
9. List of Pavement Sections with 2023 PCI and IRI values
10. Details of the 2024 Localized Distress Maintenance Plan