



ENGINEERING, REIMAGINED

CITY OF COLSTRIP

Pavement Management Plan

March 2024

Table of Contents

Table of Contents.....	i
List of Figures and Tables	ii
Appendices.....	ii
Chapter 1 Executive Summary	1
Chapter 2 Introduction.....	2
Chapter 3 Existing Roadway Conditions.....	4
Methodology.....	4
Pavement Surface Evaluation and Rating (PASER).....	4
PASER Process	6
Description of Observed PASER Ratings.....	8
PASER Rating 1: Failed	8
PASER Rating 2: Very Poor	9
PASER Rating 3: Poor	10
PASER Rating 4: Fair.....	11
PASER Rating 5: Fair.....	12
PASER Rating 6: Good.....	13
PASER Rating 7: Good.....	13
PASER Rating 8: Very Good.....	14
PASER Rating 9: Excellent	14
PASER Rating 10: Excellent-New Construction	15
Guidance on Pavement Preservation Strategies.....	15
Methodology.....	16
PASER Rating Summary.....	16
Chapter 4 Recommendations.....	21
Pavement Maintenance Projects	21
Annual Maintenance Program Recommendations	31
Structural Overlay and Reconstruction Projects	32
Ten Year Plan	33
Funding Strategies	35

LIST OF FIGURES AND TABLES

Figure 1: Road Maintenance Types Over Time..... 2
Table 1: Asphalt Pavement Treatment Costs per Year 2
Figure 2: Photo of Pavement Condition on Power Road in Colstrip..... 3
Figure 3: Study Area Roads..... 5
Figure 4: PASER Scoring Criteria 7
Figure 5: Photo of PASER Rating 1 Road on Zane Grey Road 8
Figure 6: Example Photo of PASER Rating 2 Road 9
Figure 7: PASER Rating 3 on Chisholm Drive 10
Figure 8: PASER Rating 4 on Chinook Drive 11
Figure 9: PASER Rating 5 on Castle Rock Lake Drive..... 12
Figure 10: PASER Rating 6 on Olive Drive 13
Figure 11: PASER Rating 7 on Hollister Drive..... 13
Figure 12: PASER Rating 8 on Remington Drive..... 14
Figure 13: PASER Rating 9 on Homestead Boulevard..... 14
Figure 14: PASER Rating 10 on Willow Avenue during reconstruction in 2017..... 15
Figure 15: PASER Ratings for roadways in Colstrip..... 17
Figure 16: PASER Score Distribution..... 18
Figure 17: Chip sealing operations from 2018 Pavement Maintenance 19
Table 2: Street Improvement Cost Estimates..... 19
Figure 18: Proposed Project Map..... 22
Table 4: Proposed Crack Sealing Projects..... 26
Table 5: Proposed Chip Sealing Projects 29
Table 6: Proposed Non-Structural Overlay Projects 30
Table 7: Cost to Complete Preventative Maintenance..... 31
Table 8: Proposed Structural Overlay Projects 32
Table 9: Proposed Reconstruction Projects 32
Table 10: Total Estimated Costs for Reconstruction Projects 33
Table 11A: Ten-year pavement management plan (years 2025-2030) 33
Table 11B: Ten-year pavement management plan (years 2031-2034) 34

Appendices

- Appendix A: PASER Survey Area Map
- Appendix B: PASER Ratings by Street
- Appendix C: Proposed Project Map
- Appendix D: PASER Manual

CHAPTER 1 EXECUTIVE SUMMARY

The purpose of the pavement management plan is to assess current pavement conditions in the City of Colstrip, provide recommendations for roadway treatments, and review roadway treatment costs and related funding. KLJ uses the Pavement Surface Evaluation and Rating (PASER) method of pavement analysis developed by the Federal Highway Administration (FHWA). This method is based on a visual assessment of the current street conditions and provides recommended roadway treatments based on the current pavement conditions. Each street within the study area is driven and then given a rating from 1 to 10, 1 representing that the road needs total reconstruction and 10 representing a road that has been constructed recently.

The City of Colstrip has approximately 20.5 miles of paved roadways within the study area. The PASER analysis indicates that 71 percent of the roadways within the study area are currently in good condition, which indicates a PASER rating of 6 or greater.

KLJ developed the recommended roadway treatment list based on the PASER analysis. Four treatment categories were used: preventative maintenance (crack seal and chip seal), non-structural overlays, structural overlays, and full reconstruction projects. Planning-level project costs are based on recent similar projects and Montana Department of Transportation (MDT) Average Bid Prices. Current project needs are estimated at \$2,406,000 for preventative maintenance, \$1,828,000 for non-structural overlays, \$932,000 for structural overlays, and \$1,050,000 for reconstruction projects, totaling \$6,216,000 for improvement of all roadways within the study area.

Currently, the City's general fund provides approximately \$150,000 annually for preventative maintenance of City roadways. At this level, it would take approximately sixteen (16) years to complete the identified preventative maintenance projects alone. It is more cost effective to keep a road in good operating condition than to replace an aging road. By budgeting for seal coating, crack sealing, etc., a roadway's life can be extended far more efficiently than waiting until structural improvements are required (overlays, milling, reconstruction, etc.). In short, preventative maintenance is a much less costly than corrective maintenance.

As previously noted, the City's roadways are generally in fair to good condition. To maintain this condition, it is recommended that the City establish a policy that prioritizes short term (non-structural overlay) and preventative maintenance (crack and chip sealing) projects on a reoccurring basis every 10 years and explore funding resources for longer-term (structural overlay and reconstruction) projects. Maps for the PASER study limits, street PASER scores, and the proposed treatments are attached in Appendices A, B and C.

CHAPTER 2 INTRODUCTION

The City of Colstrip is responsible for maintaining approximately 20.5 miles of paved roadways within the study area. These roadways consist almost entirely of 2-lane asphalt roads. City priorities and limited funding have not allowed for extensive regular overlays, reconstruction, seal coats, and other maintenance. Without a proactive strategy in place, roads will deteriorate faster than they can be maintained.

Understanding how road pavements age and deteriorate over time, both due to environmental conditions and traffic, is critical to developing a sustainable roadway rehabilitation and maintenance program. Maintaining and rehabilitating infrastructure at appropriate times saves public dollars in the long term. In fact, studies have found maintaining pavements through rehabilitation techniques has the potential of being 6 to 14 times more cost effective than rebuilding a deteriorated road. Figure 1 illustrates why it is easier and more cost effective to maintain good roads than it is to wait and reconstruct bad ones.

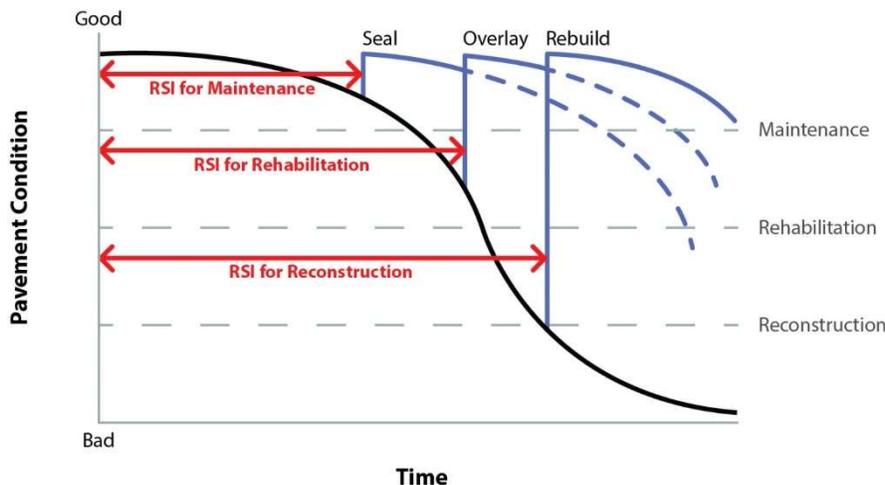


Figure 1: Road Maintenance Types Over Time

Overlays or reconstruction projects have a longer Return Service Interval (RSI) and are performed less often than chip-seals. However, as the road condition deteriorates, the costs associated with restoring the road to good condition increases exponentially. See Table 1 for a comparison of cost-per-year based on RSI.

Asphalt Pavement Treatment Cost per Year			
Treatment Type	RSI (Years)	Cost per Mile	Cost per Year
Chip and Crack Seal	10	\$115,000	\$15,000
Non-Structural Overlay (w/milling)	10	\$490,000	\$49,000
Structural Overlay (w/milling)	10+	\$585,000	\$58,500
Reconstruction	20+	\$2,100,000	\$105,000

Table 1: Asphalt Pavement Treatment Costs per Year

Pavement treatment costs are in 2023 US Dollars and are based on recent similar projects and MDT Average Bid Prices. Reconstruction project costs do not reflect any utility improvements.

New technology and processes assist in streamlining the maintenance scheduling process. Techniques such as Pavement Surface Evaluation and Rating (PASER) allow departments to create an effective treatment plan based on the conditions of the surrounding roadways. PASER is a visual method, based on engineering principles, for evaluating paved roads in a time-efficient and consistent manner. The PASER method outputs a simple 1-through-10 rating for each section of roadway studied. This provides a simple and understandable way to communicate pavement conditions to elected officials and the public and allows more time for scheduling and budgeting. The ability to know and understand roadway conditions is an extremely useful tool in scheduling preventative maintenance, instead of waiting until roads are degraded to the point where costlier corrective and emergency maintenance treatments are required.



Figure 2: Photo of Pavement Condition on Power Road in Colstrip

This study outlines the results of the PASER survey of all roads in the study area (Figure 3) and assists in determining which of those roads should receive a specific maintenance strategy, and which strategy should be used in the short-term or long-term time frame. Ultimately, the goal is to help the City effectively manage roadways while minimizing maintenance costs over time.

CHAPTER 3 EXISTING ROADWAY CONDITIONS

Methodology

This study focused on assessing the current condition of all the paved routes within the City limits. The goal is to develop a strategy to repair and maintain these roadways. Figure 3, Study Area Roads, displays all evaluated roadways.

Pavement Surface Evaluation and Rating (PASER)

PASER ratings are provided to assist in identifying roadway conditions and prioritizing improvements based on a range of factors including roughness (ride), surface distress (condition), surface skid characteristics, and structural characteristics (potholes, cracking, etc.). Based on the PASER rating, different maintenance tasks are required to maintain or raise the rating for a section of roadway. By continuing to ensure that a good roadway remains in good condition, the life of a roadway can be extended for a far-lower upfront cost than by waiting until a more-intensive and expensive maintenance method is required.

PASER Process

In order to determine the 1-to-10 PASER rating of each segment of roadway, each block of study area roads was mapped and driven. As each route was driven, a windshield survey of the road condition was completed, and pictures were taken to help document where and why each PASER rating was given. Factors such as the amount of cracking, potholes, rutting, shoulder condition, ability to drive at full speed, roadway drainage, and the presence of gravel (Zane Grey Road and Wagoneer Drive) were all considered in the rating. The roadways were segmented every block, measuring the properties of the first and last 100 feet of each block.

Consistency is important in rating. Each of the rating values is defined and kept consistent throughout the PASER rating process. For example, severe cracking, potholes, and block cracking on a roadway rated as a three (3) and each reoccurrence was rated as a three (3) consistently. No roadway segment is entirely consistent. Therefore, some averaging is necessary. A street may be rated as six (6) even though there is a single small pothole. The goal is to rate the condition that represents most of the roadway segment.

The streets included in the study were driven in November 2023. The study encompassed approximately 20.5 miles of City owned and maintained streets. Detailed route scores are included in Appendix C.

The PASER scoring criteria is illustrated in Figure 4 on the next page.

Rating system

Surface rating	Visible distress*	General condition/ treatment measures
10 Excellent	None.	New construction.
9 Excellent	None.	Recent overlay. Like new.
8 Very Good	No longitudinal cracks except reflection of paving joints. Occasional transverse cracks, widely spaced (40' or greater). All cracks sealed or tight (open less than 1/4").	Recent sealcoat or new cold mix. Little or no maintenance required.
7 Good	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks (open 1/4") due to reflection or paving joints. Transverse cracks (open 1/4") spaced 10' or more apart, little or slight crack raveling. No patching or very few patches in excellent condition.	First signs of aging. Maintain with routine crack filling.
6 Good	Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open 1/4"-1/2"), some spaced less than 10'. First sign of block cracking. Slight to moderate flushing or polishing. Occasional patching in good condition.	Shows signs of aging. Sound structural condition. Could extend life with sealcoat.
5 Fair	Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transverse cracks (open 1/2") show first signs of slight raveling and secondary cracks. First signs of longitudinal cracks near pavement edge. Block cracking up to 50% of surface. Extensive to severe flushing or polishing. Some patching or edge wedging in good condition.	Surface aging. Sound structural condition. Needs sealcoat or thin non-structural overlay (less than 2")
4 Fair	Severe surface raveling. Multiple longitudinal and transverse cracking with slight raveling. Longitudinal cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (1/2" deep or less).	Significant aging and first signs of need for strengthening. Would benefit from a structural overlay (2" or more).
3 Poor	Closely spaced longitudinal and transverse cracks often showing raveling and crack erosion. Severe block cracking. Some alligator cracking (less than 25% of surface). Patches in fair to poor condition. Moderate rutting or distortion (1" or 2" deep). Occasional potholes.	Needs patching and repair prior to major overlay. Milling and removal of deterioration extends the life of overlay.
2 Very Poor	Alligator cracking (over 25% of surface). Severe distortions (over 2" deep) Extensive patching in poor condition. Potholes.	Severe deterioration. Needs reconstruction with extensive base repair. Pulverization of old pavement is effective.
1 Failed	Severe distress with extensive loss of surface integrity.	Failed. Needs total reconstruction.

* Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.

Figure 4: PASER Scoring Criteria

Description of Observed PASER Ratings

Paved study area roads were all given a PASER rating between 1 and 10 based on existing conditions. The individual PASER ratings values are described below and an example photo of each is provided.

PASER Rating 1: Failed

A PASER rating of 1 indicates a gravel road section with virtually no visible pavement. Example: Zane Grey Road and sections of Wagoneer Drive.



Figure 5: Photo of PASER Rating 1 Road on Zane Grey Road

It is recommended the City determines whether full reconstruction is needed or if the routes are to remain gravel. If the City elects that the routes should remain gravel, maintenance can be conducted as appropriate for gravel. Two streets within the designated project area scored as a 1.

PASER Rating 2: Very Poor

A PASER rating of 2 indicates heavy gravel patches on failed asphalt with limited pavement intact, no striping, and deteriorated shoulders. Generally, you cannot (or should not) drive this road at the posted speed limit.



Figure 6: Example Photo of PASER Rating 2 Road

Roadways with a PASER rating of 2 are severely deteriorated, generally requiring reconstruction with extensive base repair. In lieu of that determination, the City could elect to pulverize any remaining asphalt and maintain the route as a gravel road. The plan to pulverize should be thoroughly scrutinized and should not be considered if there is no aggregate base below the pavement. There were no streets in the study area with a PASER rating of 2.

PASER Rating 3: Poor

A PASER rating of 3 indicates severe cracking and rutting with moderate visible potholes, heavy patching with some patches on older patches, and deteriorated shoulders. Again, you cannot (or should not) drive this road at the posted speed limit. Example: Larkspur Drive, east end of Chisholm Drive.



Figure 7: PASER Rating 3 on Chisholm Drive

Roadways with a PASER rating of 3 require patching and repair prior to any major structural overlay (greater than 2-inches). Many of the locations with a PASER rating of 3 in the area will also need some spot base repairs (dig-outs) prior to overlaying the street. Milling and removing the deteriorated area will extend the life of the overlay; however, prior to milling, a geotechnical investigation should be completed to determine the depth of the existing pavement and verify the condition of the soil below it. Within the study area, there were four streets that had a PASER rating of 3.

PASER Rating 4: Fair

A PASER rating of 4 indicates heavy cracking and rutting with moderate visible potholes; heavy patching with some patches on older patches; deteriorated shoulders; and unsealed cracks. You cannot (or should not) drive this entire road at the posted speed limit, forcing drivers to slow down in some areas. Example: Chinook Drive and Laramie Circle



Figure 8: PASER Rating 4 on Chinook Drive

Roadways with a PASER rating of 4 show significant signs of aging, requiring a structural overlay (greater than 2-inches). Many of the locations with a PASER rating of 4 in the area will also need some spot base repairs (dig-outs) prior to overlaying the street. Milling and removing the deteriorated area will extend the life of the overlay; however, prior to milling, a geotechnical investigation should be completed to determine the depth of the existing pavement and verify the condition of the soil below it. The study had six streets that received a PASER rating of 4.

PASER Rating 5: Fair

A PASER rating of 5 indicates moderate to heavy cracking with moderate rutting; moderate patching with some patches on older patches; and mostly unsealed cracks. Generally, you can still drive this road at the posted speed limit. Example: Castle Rock Lake Drive, Cottonwood Drive, and Prairieview Drive



Figure 9: PASER Rating 5 on Castle Rock Lake Drive

Roadways with a PASER rating of 5 primarily consist of aging asphalt but exhibit sound structural conditions. These roadways would benefit from patching where necessary, followed by a non-structural overlay (less than 2-inches). Twenty-two streets within the study area were rated 5.

PASER Rating 6: Good

A PASER rating of 6 indicates moderate-to-heavy cracking or some rutting exists, as well as moderate polishing with occasional patches visible, and mostly-sealed cracks. Example: Olive Drive



Figure 10: PASER Rating 6 on Olive Drive

Roadways with a PASER rating of 6 show only light signs of aging. Roadway life can be extended with routine crack sealing and a sealcoat. There were twenty-six streets in the study area that were rated a 6.

PASER Rating 7: Good

A PASER rating of 7 indicates some cracking, no raveling and little rutting; there are no patches visible and cracks are sealed. A PASER rating of 7 indicates that the roadway is not in need of immediate repair. Example: Hollister Drive



Figure 11: PASER Rating 7 on Hollister Drive

Roadways with a PASER rating of 7 show very few signs of aging and can be maintained with routine crack filling. Twenty-eight streets in within the study area received a rating of 7.

PASER Rating 8: Very Good

A PASER rating of 8 indicates minor tight cracking present, no raveling or rutting, and no visible patches. A PASER rating of 8 indicates that the roadway is not in need of repair. Example: Remington Drive, Ballantine Drive, and a section of Power Road.



Figure 12: PASER Rating 8 on Remington Drive

PASER Rating 9: Excellent

A PASER rating of 9 indicates a relatively new road with new striping. This is usually a roadway that was reconstructed or overlaid recently. Example: Homestead Boulevard and Main Street



Figure 13: PASER Rating 9 on Homestead Boulevard

Roadways with PASER ratings of either 8 or 9 require no immediate maintenance. There were ten streets in the study area that were rated either an 8 or a 9. Routine crack filling and maintenance should be performed over time to continue to extend the life of the roadway.

PASER Rating 10: Excellent-New Construction

A PASER rating of 10 indicates a brand-new road. This is a roadway that has generally been reconstructed or overlaid in the last year.



Figure 14: PASER Rating 10 on Willow Avenue during reconstruction in 2017

Roadways with a PASER rating of 10 are generally newly constructed and require no maintenance. There were no streets within the study area that were rated a 10.

Guidance on Pavement Preservation Strategies

Treatments timing is particularly important in order to maintain a cost-efficient budget. For example, crack sealing is best performed when temperatures are moderately cool, usually in the spring or fall months. Cooler temperatures create conditions for cracks to fully open, allowing for the entire crack to be sealed. More in-depth maintenance (minor overlays, chip seals, etc.) can be done in the summer months and MDT generally prohibits chip sealing operations before May 1st and after August 31st (September 15th is the cut-off date per Montana Public Works Standard Specifications (MPWSS)), ensuring minimum-temperature guidelines are followed and ensuring the cover material will stick to the seal material.

Crack sealing can also be performed with less labor involved, resulting in reduced workforce needs, whereas more-intensive maintenance is better completed in the summer when maintenance departments typically have a larger seasonal workforce. Higher temperatures also lessen the cure time required, allowing the roadway to be opened in a shorter time frame. Sealing does need to be performed in moderation. In addition to these considerations for temperature, it is also important to consider moisture levels as excessive moisture can prohibit sealant from bonding properly. Full reconstruction and structural overlays are generally more labor and equipment intensive and, as a result, more expensive.

Methodology

Needs Assessments are not simply looking at the lower-scoring roads and saying that they are in the worst conditions and therefore have the most need. Other factors such as funding, traffic volume, truck traffic, roadway safety, construction history, maintenance history, level of service (LOS) needed, connections, and other factors should also be considered.

Traffic volume and roadway level of service may be considered when developing a pavement management plan; however, neither of these were included in this project. Generally, the City's roadways likely have LOS A ratings, indicating they have free flowing traffic with very limited or no congestion.

PASER Rating Summary

Every street and cul-de-sac were given a PASER score, and the results were mapped. Figure 15 is a map that displays a color-coded PASER ratings system. Blue indicates the highest values/best conditions, with red representing the lowest values or worst conditions found in the study area.

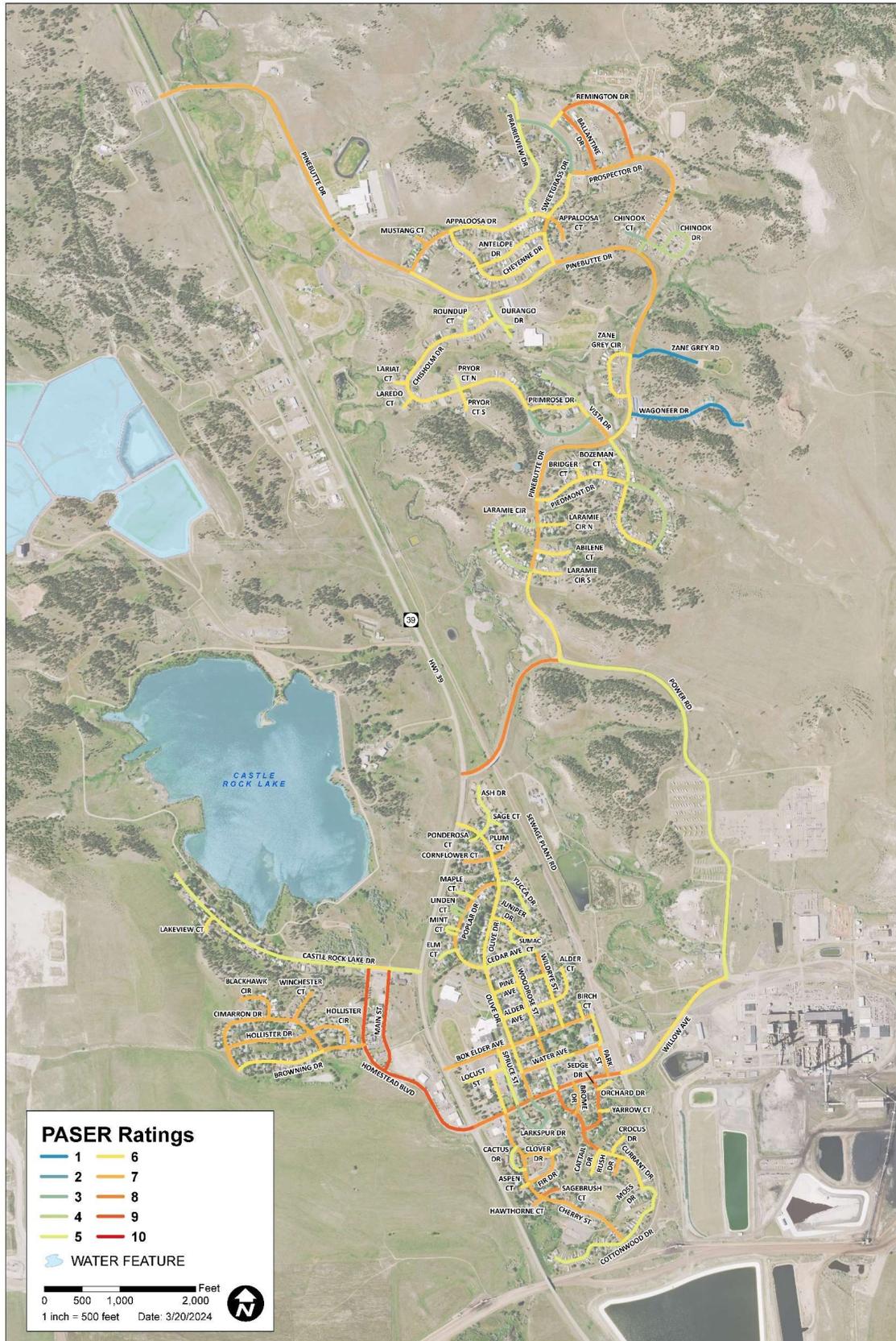


Figure 15: PASER Ratings for roadways in Colstrip

The average (mean) rating for studied roadways is a PASER rating of 6.06. In short, this indicates that the scored roadways tend to be in fair to good condition. In fact, assuming a rating of 6 is considered the minimum acceptable pavement condition, (road not requiring rehabilitation) then 71 percent of scored roads currently meet that standard. This is graphed in Figure 16, which shows there are more miles of green and blue than there are of red and yellow.

The ratings per mile are broken down in Figure 16 below.

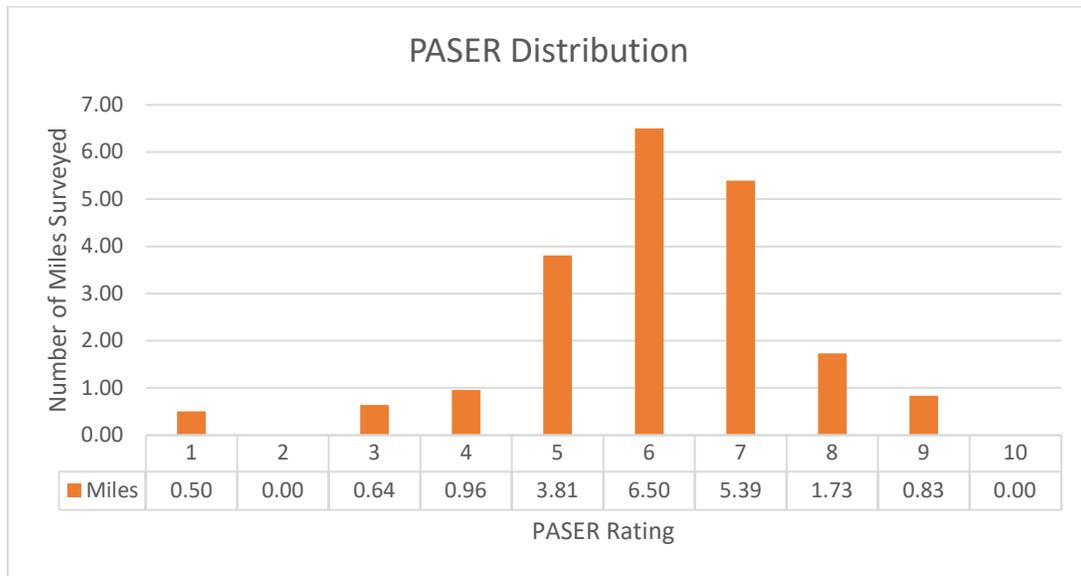


Figure 16: PASER Score Distribution

Figure 16 outlines several measures related to the City’s paved routes. First, it indicates that the majority of the City’s streets are in good to fair condition. Additionally, it indicates the amount of backlog for preventative maintenance projects throughout the City. The PASER scores of 6, 7, and 8 are used to determine the preventative maintenance projects. These roadways account for 67 percent of the City’s streets. It also shows the amount of backlog for more-corrective projects (structural overlays, reconstruction projects). Routes should be reviewed, and construction projects should be programmed accordingly. As an example, if a route with a lower PASER score also needs utility replacement, a structural overlay may not be the best treatment, but rather reconstruction should be considered.



Figure 17: Chip sealing operations from 2018 Pavement Maintenance

Table 2 provides cost estimates for street improvements per mile for major maintenance tasks associated with anticipated work. Cost estimates are in 2023 US Dollars and based on recent similar projects and MDT Average Bid prices. It should be noted that costs can vary widely.

<i>Street Improvement Cost Estimates</i>	
Treatment Type	Cost per Mile*
Complete Reconstruction (Complete Streets)	\$4,100,000
Reconstruction	\$2,100,000
Structural Overlay (w/milling)	\$585,000
Non-Structural Overlay (w/milling)	\$490,000
Crack and Chip Seal	\$115,000
Chip Seal	\$76,500
Crack Seal	\$35,500

Table 2: Street Improvement Cost Estimates

*Note: Costs include fees for engineering, design, and construction observation.

For planning and budgeting purposes, construction costs should be expected to increase at a 5 to 6 percent annual inflation rate.

The treatment types in Table 2 are common techniques to maintain pavement. For the purpose of this report, the techniques are defined as follows. Crack sealing is sealing pavement cracks with hot tar to prevent moisture from seeping into the pavement, which can cause more rapid deterioration. Chip sealing is the process of laying a thin layer of hot tar on top of the pavement and then adding fine aggregate to hot tar. Non-structural overlay includes milling of existing asphalt and placing a 3-inch asphalt overlay to the milled surface. Structural overlay includes milling the existing asphalt and adding a 3-inch asphalt overlay with subgrade stabilization.

Reconstruction includes subgrade stabilization, 4 inches of new asphalt, curb and gutter, and sidewalks. Complete streets can include bike lanes, pedestrian crossings, median islands, landscaped boulevards, and curb extensions as well as the actual street construction.

It is important to record all associated maintenance costs (crack sealing, seal coating, etc.). No matter how minor the task, accurate and concise cost tracking enables more accurate programming, scheduling, and budgeting. Costs vary by region, so by recording actual costs, the City is empowered to create and maintain an accurate pavement management plan to be applied for each area of town.

CHAPTER 4 RECOMMENDATIONS

A complete list of short- and long-range project needs has been identified and is shown in Figure 18. The City of Colstrip has fallen behind on overall maintenance of the existing pavement street system. Before an annual maintenance program of Colstrip's paved street system can be fully implemented, it is recommended that the City complete short range projects that have been identified.

It is recommended that pavement conditions govern the types of rehabilitation needed. The rehabilitation projects should be prioritized as follows: 1) preventive maintenance (crack seal and chip seal), 2) non-structural overlays, 3) structural overlays, and 4) reconstruction. The City of Colstrip should use all four strategies/interventions to maintain paved routes. It is anticipated that most of this work will be contracted out to paving contractors.

Pavement Maintenance Projects

Recommendations in this Pavement Management Plan are focused on pavement maintenance crack seal, chip seal, and non-structural overlays projects. Pavement maintenance projects are those that should be completed within the next 1-5 years and before pavement conditions deteriorate further.

Table 4 shows projects that should be programmed to begin in the spring or late summer for crack sealing. Once the crack sealing is complete the chip sealing (Table 5) should be programmed for the following year in early summer to provide the best application temperatures and to give traffic time to help compact the chips before winter snow plowing operations begin. Note that not all streets that will be crack sealed will also receive a chip seal, since some streets received a PASER rating of 8 or 9 and do not require a chip seal at this time.

Table 6 shows recommended non-structural overlay projects. These were separated into two Phases (1 and 2) to allow costs to be spread over a two-year period. Ideally, these should also be completed as soon as possible. If completion of these projects is delayed, consideration of crack sealing and chip sealing may enable them to avoid further deterioration that could result in a requirement for structural overlays. To the degree possible, projects should be bundled to get better bid prices and to spread out mobilization costs.

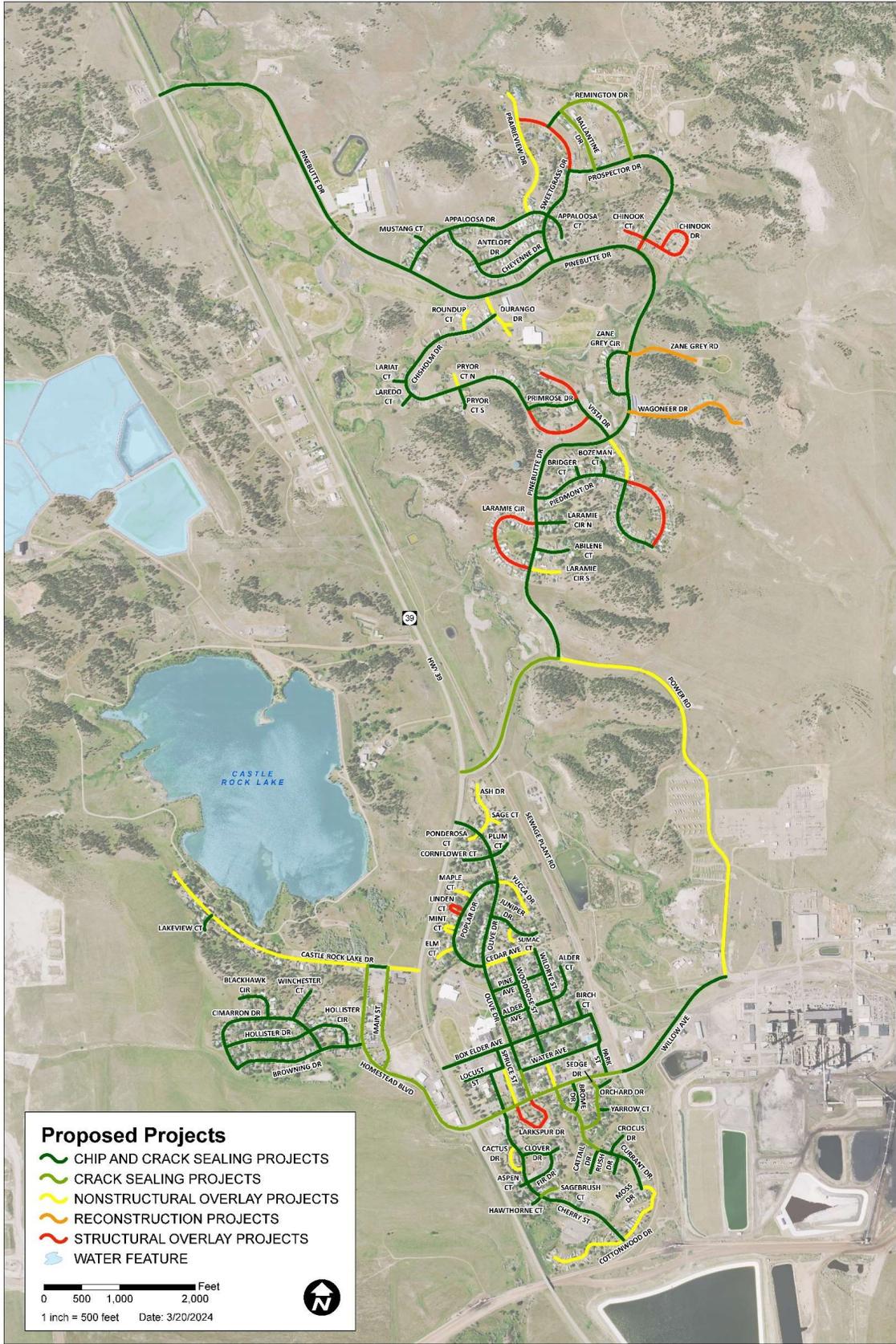


Figure 18: Proposed Project Map

<i>Proposed Crack Sealing Projects</i>					
Street Name	Beginning Intersection	Ending Intersection	PASER Rating	Route Length (feet)	Estimated Construction Costs:
Homestead Boulevard	Castle Rock Lake Drive	Highway 39	9	3007	\$20,267.18
Main Street	Castle Rock Lake Drive	Homestead Boulevard	9	1390	\$9,368.60
Remington Drive	Ballantine Drive	Prospector Drive	8	1420	\$9,570.80
Ballantine Drive	Remington Drive	Prospector Drive	8	903	\$6,086.22
Currant Drive	Willow Avenue	Cattail Drive	8	1044	\$7,036.56
Orchard Drive	Currant Drive	Willow Avenue	8	825	\$5,560.50
Sagebrush Court			8	228	\$1,536.72
Olive Drive	Willow Avenue	Water Avenue	8	389	\$2,621.86
Willow Avenue	Highway 39	RR tracks	8	2121	\$14,295.54
Power Road	Highway 39	Pinebutte Drive	8	2215	\$14,929.10
Appaloosa Drive	Pinebutte Drive	Cheyenne Drive	7	777	\$16,495.71
Appaloosa Drive	Sweetgrass Drive	Appaloosa Court	7	368	\$7,812.64
Mustang Court			7	180	\$3,821.40
Sweetgrass Drive	Antelope Drive	Appaloosa Drive	7	228	\$4,840.44
Prospector Drive	Sweetgrass Drive	Chinook Drive	7	2428	\$51,546.44
Vista Drive	Chisholm Drive	Pinebutte Drive	7	400	\$8,492.00
Brome Drive	Willow Avenue	Currant Drive	7	416	\$8,831.68
Rush Drive	Currant Drive	Cul-De-Sac	7	241	\$5,116.43
Winchester Court	Cimarron Drive	Cul-De-Sac	7	442	\$9,383.66

Hollister Drive	Browning Drive	Cimarron Drive	7	1863	\$39,551.49
Cimarron Drive	Browning Drive	Browning Drive	7	2082	\$44,200.86
Browning Drive	Cimarron Drive	Homestead Boulevard	7	564	\$11,973.72
Blackhawk Circle			7	603	\$12,801.69
Pinebutte Drive	Highway 39	Appaloosa Drive	7	4527	\$96,108.21
Pinebutte Drive	Sweetgrass Drive	Zane Grey Road	7	2647	\$56,195.81
Pinebutte Drive	Vista Drive	Laramie Circle South	7	2429	\$51,567.67
Cherry Street	Willow Avenue	Cottonwood Drive	7	2535	\$53,818.05
Fir Drive	Clover Drive	Cherry Street	7	560	\$11,888.80
Clover Drive	Cherry Street	Fir Drive	7	380	\$8,067.40
Hawthorne Circle			7	159	\$3,375.57
Box Elder Avenue	Highway 39	Park Avenue	7	2049	\$43,500.27
Park Street	Water Avenue	Willow Avenue	7	415	\$8,810.45
Water Avenue	Olive Drive	Wood Rose Street	7	362	\$7,685.26
Water Avenue	Wildrye Street	Park Avenue	7	354	\$7,515.42
Cornflower Court			7	371	\$7,876.33
Plum Court			7	278	\$5,901.94
Poplar Drive	Elm Court	Olive Drive	7	1137	\$24,138.51
Wildrye Street	Cedar Avenue	Pine Avenue	7	345	\$7,324.35
Woodrose Street	Water Avenue	Box Elder Avenue	7	385	\$8,173.55
Appaloosa Drive	Cheyenne Drive	Sweetgrass Drive	6	1366	\$29,000.18
Cheyenne Drive	Appaloosa Drive	Sweetgrass Drive	6	1709	\$36,282.07

Sweetgrass Drive	Pinebutte Drive	Antelope Drive	6	422	\$8,959.06
Sweetgrass Drive	Appaloosa Drive	Prospector Drive	6	665	\$14,117.95
Remington Drive	Sweetgrass Drive	Ballantine Drive	6	286	\$6,071.78
Zane Grey Circle	Pinebutte Drive	Pinebutte Drive	6	958	\$20,338.34
Primrose Drive	Chisholm Drive	Vista Drive	6	679	\$14,415.17
Piedmont Drive	Pinebutte Drive	Vista Drive	6	1280	\$27,174.40
Bozeman Court			6	255	\$5,413.65
Bridger Court			6	274	\$5,817.02
Vista Drive	Primrose Drive	Chisholm Drive	6	257	\$5,456.11
Vista Drive	Piedmont Drive	Piedmont Drive	6	1124	\$23,862.52
Chisholm Drive	Durango Drive	Primrose Drive	6	3538	\$75,111.74
Pryor Court South			6	254	\$5,392.42
Laredo Court			6	173	\$3,672.79
Lariat Court			6	155	\$3,290.65
Currant Drive	Cattail Drive	Cottonwood Drive	6	829	\$17,599.67
Cattail Drive	Currant Drive	Cul-De-Sac	6	329	\$6,984.67
Crocus Drive	Currant Drive	Cul-De-Sac	6	265	\$5,625.95
Sedge Drive			6	199	\$4,224.77
Yarrow Court			6	94	\$1,995.62
Browning Drive	Cimarron Drive	Cimarron Drive	6	1168	\$24,796.64
Abeliene Court			6	450	\$9,553.50
Laramie Circle North			6	361	\$7,664.03
Pinebutte Drive	Appaloosa Drive	Sweetgrass Drive	6	2085	\$44,264.55
Pinebutte Drive	Zane Grey Road	Vista Drive	6	1207	\$25,624.61
Pinebutte Drive	Laramie Circle South	Power Road	6	1311	\$27,832.53
Castle Rock Lake Drive	Main Street	Homestead Boulevard	6	276	\$5,859.48

Lakeview Court			6	224	\$4,755.52
Aspen Circle			6	111	\$2,356.53
Cherry Street	Willow Avenue	Locust Street	6	548	\$11,634.04
Clover Drive	Fir Drive	Cul-De-Sac	6	110	\$2,335.30
Spruce Street	Box Elder Avenue	Locust Street	6	255	\$5,413.65
Birch Court			6	206	\$4,373.38
Park Street	Box Elder Avenue	Water Avenue	6	406	\$8,619.38
Water Avenue	Wood Rose Street	Wildrye Street	6	372	\$7,897.56
Olive Drive	Water Avenue	Highway 39	6	3617	\$76,788.91
Poplar Drive	Olive Drive	Elm Court	6	492	\$10,445.16
Juniper Drive	Olive Drive	Cul-De-Sac	6	702	\$14,903.46
Wildrye Street	Pine Avenue	Box Elder Avenue	6	729	\$15,476.67
Woodrose Street	Box Elder Avenue	Cedar Avenue	6	1081	\$22,949.63
Pine Avenue	Olive Drive	Wildrye Street	6	709	\$15,052.07
Alder Avenue	Olive Drive	Wildrye Street	6	710	\$15,073.30
Alder Court			6	532	\$11,294.36
Locust Street	Dogwood Street	Spruce Street	6	539	\$11,442.97
Willow Avenue	RR tracks	Power Road	6	1939	\$41,164.97
Total Crack Sealing Project Costs:					\$1,467,000

Table 4: Proposed Crack Sealing Projects

<i>Proposed Chip Sealing Projects</i>					
Street Name	Beginning Intersection	Ending Intersection	PASER Rating	Route Length (feet)	Estimated Construction Costs:
Appaloosa Drive	Pinebutte Drive	Cheyenne Dr	7	777	\$11,258.73
Appaloosa Drive	Sweetgrass Drive	Appaloosa Court	7	368	\$5,332.32
Mustang Court			7	180	\$2,608.20
Sweetgrass Drive	Antelope Drive	Appaloosa Drive	7	228	\$3,303.72
Prospector Drive	Sweetgrass Drive	Chinook Drive	7	2428	\$35,181.72
Vista Drive	Chisholm Drive	Pinebutte Dr.	7	400	\$5,796.00
Brome Drive	Willow Avenue	Currant Drive	7	416	\$6,027.84
Rush Drive	Currant Drive	Cul-De-Sac	7	241	\$3,492.09
Winchester Court	Cimarron Drive	Cul-De-Sac	7	442	\$6,404.58
Hollister Drive	Browning Drive	Cimarron Dr.	7	1863	\$26,994.87
Cimarron Drive	Browning Drive	Browning Drive	7	2082	\$30,168.18
Browning Drive	Cimarron Drive	Homestead Boulevard	7	564	\$8,172.36
Blackhawk Circle			7	603	\$8,737.47
Pinebutte Drive	Highway 39	Appaloosa Drive	7	4527	\$65,596.23
Pinebutte Drive	Sweetgrass Drive	Zane Grey Road	7	2647	\$38,355.03
Pinebutte Drive	Vista Drive	Laramie Circle South	7	2429	\$35,196.21
Cherry Street	Willow Avenue	Cottonwood Drive	7	2535	\$36,732.15
Fir Drive	Clover Drive	Cherry Street	7	560	\$8,114.40
Clover Drive	Cherry Street	Fir Drive	7	380	\$5,506.20
Hawthorne Circle			7	159	\$2,303.91
Box Elder Ave.	Highway 39	Park Avenue	7	2049	\$29,690.01

Park Street	Water Avenue	Willow Ave.	7	415	\$6,013.35
Water Avenue	Olive Drive	Wood Rose Street	7	362	\$5,245.38
Water Avenue	Wildrye Street	Park Avenue	7	354	\$5,129.46
Cornflower Court			7	371	\$5,375.79
Plum Court			7	278	\$4,028.22
Poplar Drive	Elm Court	Olive Drive	7	1137	\$16,475.13
Wildrye Street	Cedar Avenue	Pine Avenue	7	345	\$4,999.05
Woodrose Street	Water Avenue	Box Elder Avenue	7	385	\$5,578.65
Appaloosa Drive	Cheyenne Drive	Sweetgrass Drive	6	1366	\$19,793.34
Cheyenne Drive	Appaloosa Drive	Sweetgrass Drive	6	1709	\$24,763.41
Sweetgrass Drive	Pinebutte Drive	Antelope Drive	6	422	\$6,114.78
Sweetgrass Drive	Appaloosa Drive	Prospector Drive	6	665	\$9,635.85
Remington Drive	Sweetgrass Drive	Ballantine Drive	6	286	\$4,144.14
Zane Grey Circle	Pinebutte Drive	Pinebutte Drive	6	958	\$13,881.42
Primrose Drive	Chisholm Drive	Vista Drive	6	679	\$9,838.71
Piedmont Drive	Pinebutte Drive	Vista Drive	6	1280	\$18,547.20
Bozeman Court			6	255	\$3,694.95
Bridger Court			6	274	\$3,970.26
Vista Drive	Primrose Drive	Chisholm Drive	6	257	\$3,723.93
Vista Drive	Piedmont Drive	Piedmont Drive	6	1124	\$16,286.76
Chisholm Drive	Durango Drive	Primrose Drive	6	3538	\$51,265.62
Pryor Court South			6	254	\$3,680.46
Laredo Court			6	173	\$2,506.77
Lariat Court			6	155	\$2,245.95
Currant Drive	Cattail Drive	Cottonwood Drive	6	829	\$12,012.21

Cattail Drive	Currant Drive	Cul-De-Sac	6	329	\$4,767.21
Crocus Drive	Currant Drive	Cul-De-Sac	6	265	\$3,839.85
Sedge Drive			6	199	\$2,883.51
Yarrow Court			6	94	\$1,362.06
Browning Drive	Cimarron Drive	Cimarron Drive	6	1168	\$16,924.32
Abeliene Court			6	450	\$6,520.50
Laramie Circle North			6	361	\$5,230.89
Pinebutte Drive	Appaloosa Drive	Sweetgrass Drive	6	2085	\$30,211.65
Pinebutte Drive	Zane Grey Road	Vista Drive	6	1207	\$17,489.43
Pinebutte Drive	Laramie Circle S.	Power Road	6	1311	\$18,996.39
Castle Rock Lake Drive	Main Street	Homestead Boulevard	6	276	\$3,999.24
Lakeview Court			6	224	\$3,245.76
Aspen Circle			6	111	\$1,608.39
Cherry Street	Willow Avenue	Locust Street	6	548	\$7,940.52
Clover Drive	Fir Drive	Cul-De-Sac	6	110	\$1,593.90
Spruce Street	Box Elder Ave.	Locust Street	6	255	\$3,694.95
Birch Court			6	206	\$2,984.94
Park Street	Box Elder Avenue	Water Avenue	6	406	\$5,882.94
Water Avenue	Wood Rose Street	Wildrye Street	6	372	\$5,390.28
Olive Drive	Water Avenue	Highway 39	6	3617	\$52,410.33
Poplar Drive	Olive Drive	Elm Court	6	492	\$7,129.08
Juniper Drive	Olive Drive	Cul-De-Sac	6	702	\$10,171.98
Wildrye Street	Pine Avenue	Box Elder Avenue	6	729	\$10,563.21
Woodrose Street	Box Elder Avenue	Cedar Avenue	6	1081	\$15,663.69
Pine Avenue	Olive Drive	Wildrye St.	6	709	\$10,273.41
Alder Avenue	Olive Drive	Wildrye St.	6	710	\$10,287.90
Alder Court			6	532	\$7,708.68
Locust Street	Dogwood Street	Spruce Street	6	539	\$7,810.11
Willow Avenue	RR tracks	Power Road	6	1939	\$28,096.11
Total Chip Sealing Project Costs:					\$939,000

Table 5: Proposed Chip Sealing Projects

<i>Proposed Non-Structural Milling and Overlay Projects</i>					
Street Name	Beginning Intersection	Ending Intersection	PASER Rating	Routh Length (feet)	Estimated Construction Costs:
Prairieview Drive	Appaloosa Drive	Cul-De-Sac	5	1701	\$158,805.36
Vista Drive	Pinebutte Drive	Piedmont Drive	5	637	\$59,470.32
Pryor Court North			5	175	\$16,338.00
Durango Drive	Pinebutte Drive	Elem. School	5	636	\$59,376.96
Power Road	Pinebutte Drive	Willow Ave.	5	5595	\$522,349.20
Roundup Court			5	285	\$26,607.60
Phase 1 Sub Total:					\$842,947.44
Laramie Circle South			5	381	\$35,570.16
Castle Rock Lake Drive	Highway 39	Main Street	5	407	\$37,997.52
Castle Rock Lake Drive	Homestead Boulevard	Cul-De-Sac	5	2943	\$274,758.48
Cactus Drive	Cherry Street	Cherry Street	5	427	\$39,864.72
Spruce Street	Locust Street	Willow Ave.	5	532	\$49,667.52
Ponderosa Court			5	161	\$15,030.96
Ash Street	Olive Drive	Cul-De-Sac	5	702	\$65,538.72
Sage Court			5	146	\$13,630.56
Yucca Drive	Olive Drive	Cul-De-Sac	5	614	\$57,323.04
Elm Court			5	260	\$24,273.60
Mint Court			5	322	\$30,061.92
Maple Court			5	226	\$21,099.36
Sumac Court			5	220	\$20,539.20
Cedar Avenue	Olive Drive	Wildrye Street	5	694	\$64,791.84
Woodrose Street	Willow Avenue	Water Avenue	5	357	\$33,329.52
Cottonwood Drive	Currant Drive	Cul-De-Sac	5	2153	\$201,004.08
Phase 2 Sub Total:					\$984,481.20
Total Non-Structural Milling and Overlay Project Costs:					\$1,828,000

Table 6: Proposed Non-Structural Overlay Projects

Annual Maintenance Program Recommendations

The City of Colstrip currently has annual street maintenance funds set aside from the general fund. Table 7 indicates that the amount that the City has set aside (\$150,000/year) for preventive maintenance should be increased to \$250,000/year to ensure that the streets remain in good condition. Increasing the contribution to this fund will help address all preventative maintenance, potentially saving the City money in the long term, by avoiding costly reconstruction projects.

Table 7 shows the cost per year needed to ensure that all preventative maintenance is completed on a 10-year schedule. Ideally, each paved road should be crack sealed and receive a seal coat every 10 years, and a nonstructural overlay every 20 years. However, the City may not be able to afford overlays every 20 years, so the cycle for doing overlays may need to be extended to 30 years.

<i>Cost to Complete Preventative Maintenance</i>			
Preventative Maintenance Costs	Cost	RSI	Cost per Year
Crack Sealing	\$ 1,467,000	10	\$ 250,000
Chip Sealing	\$ 939,000		

Table 7: Cost to Complete Preventative Maintenance

Due to the costs and length of roadways that need to be crack and chip sealed, there should be a rotation for these project types. One-year cracks can be sealed and the next the streets can be chipped sealed. Rotating these types of projects will help to keep streets in good condition.

It is important to note that future overlays need to avoid filling up the concrete curb and gutter. This can create drainage issues throughout the area. When water doesn't have adequate drainage, it can sit in the same area and cause streets to deteriorate faster. To avoid this dilemma, all overlay costs included the task of milling the road first.

By following a schedule of improvements, the City will prolong roadway life and reduce premature failure and reduce maintenance costs. With an adopted schedule of road maintenance activities, the City can then consider road rehabilitation and reconstruction priorities, look for project funding, and as needed, save up for completing the more expensive, long-term projects. The long-term projects (structural overlays and reconstruction) have also been categorized in the following tables. A map of all proposed projects is shown in Figure 18 and in Appendix C.

Structural Overlay and Reconstruction Projects

Higher cost projects are those that require structural overlays or reconstruction. These projects may take time (5 years or more) for the City of Colstrip to raise adequate funding to complete these projects.

Prior to design of structural overlay or reconstruction projects, it is recommended that geotechnical investigations, including coring of the roads, be completed. This will assist in determining the existing depth of the asphalt pavement and the depth of the gravel base existing underneath the asphalt. Any deficiencies or anomalies of the depth of pavement or base course might suggest a different treatment needed than what the PASER rating alone might suggest.

<i>Proposed Structural Milling and Overlay Projects</i>					
Street Name	Beginning Intersection	Ending Intersection	PASER Rating	Route Length (feet)	Estimated Construction Costs:
Prospector Drive	Chinook Drive	Pinebutte Drive	4	185	\$20,468.40
Chinook Drive	Prospector Drive	Chinook Drive (Circle)	4	1279	\$141,508.56
Piedmont Drive	Vista Drive	Vista Drive	4	1174	\$129,891.36
Vista Drive	Cul-De-Sac	Primrose Drive	4	604	\$66,826.56
Laramie Circle	Pinebutte Drive	Pinebutte Drive	4	1422	\$157,330.08
Linden Court			4	390	\$43,149.60
Sweetgrass Dr.	Prospector Drive	Prairieview Drive	3	1108	\$122,589.12
Chinook Drive	Prospector Drive	Chinook Ct.	3	274	\$30,315.36
Chisholm Drive	Primrose Drive	Vista Drive	3	1025	\$113,406.00
Larkspur Drive	Willow Avenue	Willow Ave.	3	962	\$106,435.68
Total Structural Milling and Overlay Project Costs:					\$932,000

Table 8: Proposed Structural Overlay Projects

<i>Proposed Reconstruction Projects</i>					
Street Name	Beginning Intersection	Ending Intersection	PASER Rating	Route Length (feet)	Estimated Construction Costs:
Wagoneer Drive	Pinebutte Drive	Cul-De-Sac	1	1673	\$659,295.84
Zane Grey Road	Pinebutte Drive	Cemetery	1	992	\$390,927.36
Total Non-Structural Overlay Project Costs:					\$1,050,000

Table 9: Proposed Reconstruction Projects

Table 10 shows the total estimated costs for all proposed projects within the study area.

<i>Total Estimated Costs</i>	
Type of Treatment	Total Estimated Construction Costs:
Crack Sealing	\$1,467,000
Chip and Crack Sealing	\$939,000
Non-Structural Overlay (w/milling)	\$1,828,000
Structural Overlay (w/milling)	\$932,000
Reconstruction	\$1,050,000
Total:	\$6,216,000

Table 10: Total Estimated Costs for Reconstruction Projects

Ten Year Plan

To bring the City street system into good condition it will take approximately six years. It is recommended that the city follow the projects and financial commitments provided in Table 11A to address current pavement needs over the next six years as part of a 10-year plan. The remaining four years of the 10-year plan are shown in Table 11B. This reflects the recommended annual budget for pavement maintenance following completion of the next six years' worth of projects.

Ideally in FY 2025, all the proposed crack sealing will be finished so that in FY 2026 chip sealing can be conducted. By keeping all of the crack sealing and chip sealing in their own years, it should help get more bids to ensure the best cost for the City.

Ten Year Plan						
	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Crack Sealing	\$1,467,700					
Chip Sealing		\$939,000				
Non-Structural Overlay (Phase 1)			\$842,900			
Non-Structural Overlay (Phase 2)				\$984,400		
Structural Overlay					\$932,000	
Reconstruction						\$1,050,000

Table 11A: Ten-year pavement management plan (years 2025-2030)

Ten Year Plan				
	FY 2031	FY 2032	FY 2033	FY 2034
Pavement Maintenance Fund	\$250,000			
Pavement Maintenance Fund		\$250,000		
Pavement Maintenance Fund			\$250,000	
Pavement Maintenance Fund				\$250,000

Table 11B: Ten-year pavement management plan (years 2031-2034)

In FY 2027, it is proposed that the City begin working on non-structural overlay projects. Due to the financial commitment for proposed non-structural overlay projects, it is recommended that the city separate these projects into two years. The first year (\$842,900) will complete all the non-structural overlay projects that are east of the railroad tracks. The following year in FY 2028, the additional non-structural overlay projects (\$984,400) west of the railroad tracks will be completed. In FY 2029, it is recommended that the City complete the identified structural overlay projects. The reconstruction projects were extended out to FY 2030. This is because the high cost per mile and these projects are not on highly travelled streets. If the city secures the funding, these projects can be added into any of the other years.

To ensure that the streets remain in good condition, it is important that the City start an annual pavement maintenance program. Starting in FY 2031, the City should begin setting aside \$250,000 for pavement maintenance. These funds can be used for immediate needs or can be saved and used for larger projects in the future.

Funding Strategies

The City's street maintenance funding of \$150,000 (\$100,000 for chip sealing and \$50,000 for crack sealing) annually cannot support the need as identified. Even if the City elected to use only the annual street maintenance funds for preventative maintenance, it would take the City approximately sixteen (16) years to complete those projects. After five (5) years, some of the roadways that scored a PASER rating of 6 in 2023, will experience additional deterioration and may require rehabilitation or reconstruction. Additionally, this scenario only addresses preventative maintenance, leaving any reconstruction or overlay projects untouched.

It is recommended the City consider increasing current funding for street maintenance and exploring alternative funding resources for the identified projects. There are significant State and Federal grant funds available. Many of these require a 20% local match, and most require a case to be made that extends beyond normal maintenance. Although these highly competitive grants often apply to large (over \$1 million) projects, there may be resources available to assist in planning (design) and construction costs. These can often be used to supplement existing community resources to successfully complete projects, especially if the City can demonstrate local "buy in" and matching dollars.

Currently, almost all grant monies are tied to safety improvements and/or improvements that address pedestrian bicycle travel needs. Prior to determining whether a project is a good candidate for grant monies, it is recommended that the City consider whether safety issues or improvements pertain to the given project, and whether pedestrian or bicycle improvements can be added to the pavement needs of the corridor.

It is further recommended the City consider addressing and correcting all identified projects before implementing an annual preventative maintenance schedule that will keep the streets in good condition. Options that would increase the annual street maintenance fund include, but are not limited to, creation of Special Improvement Districts (SID) and/or Tax Increment Financing (TIF) Districts.

Appendix A: PASER Survey Area Map



PASER Study Area

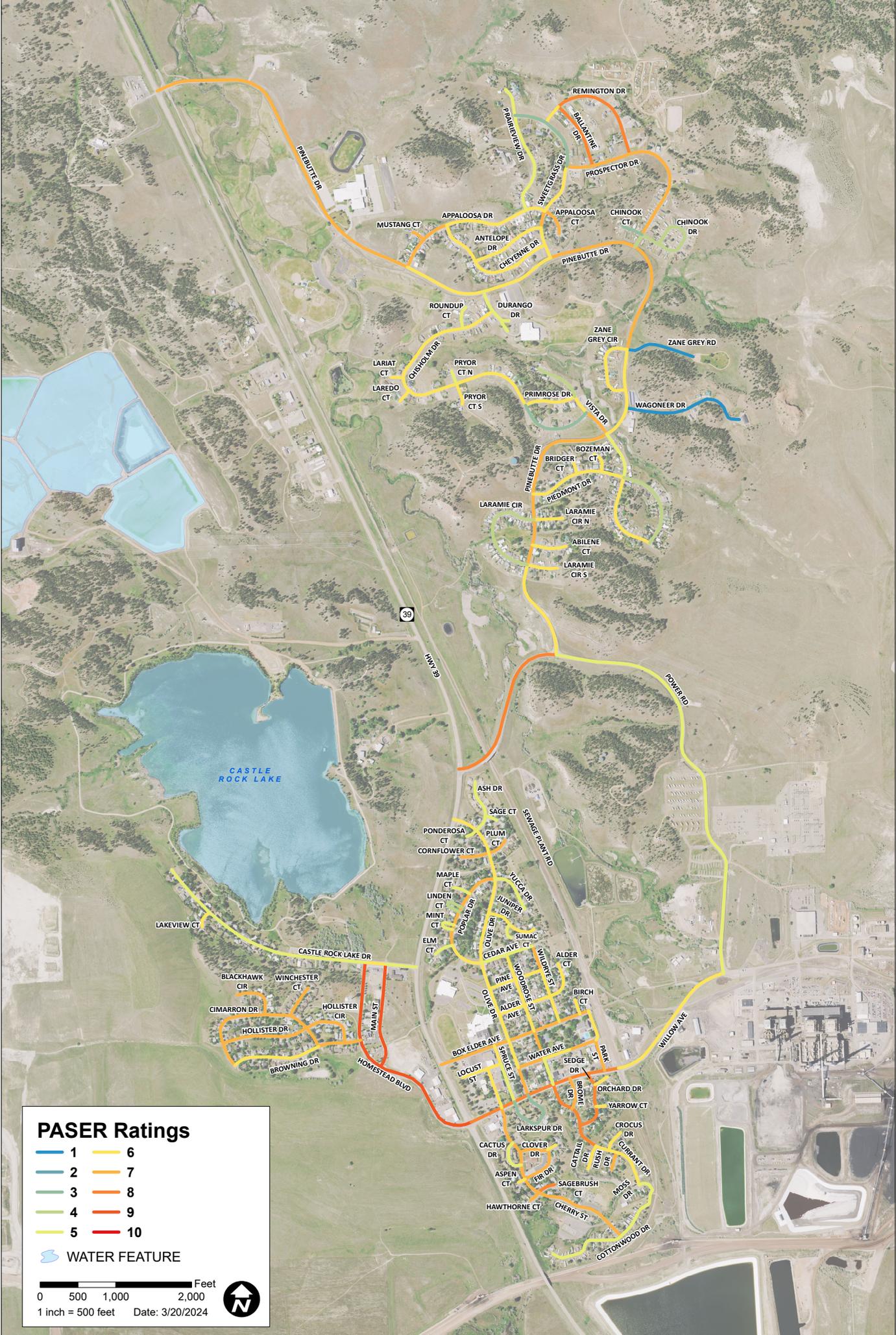
— PASER Route



1 inch equals 1,000 feet
Date: 1/8/2024



Appendix B: PASER Ratings by Street



PASER Ratings

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

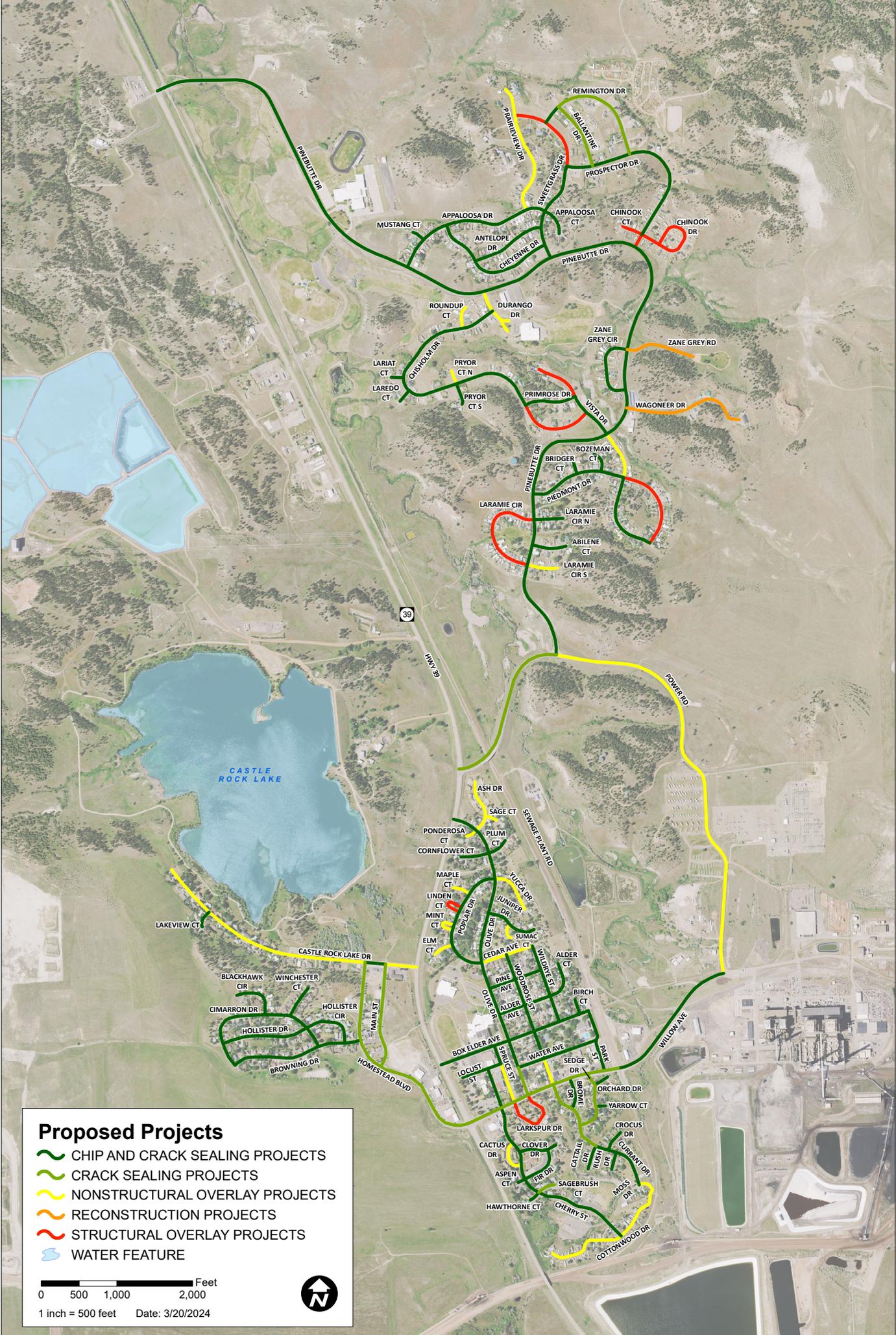
WATER FEATURE

0 500 1,000 2,000 Feet

1 inch = 500 feet Date: 3/20/2024



Appendix C: Proposed Project Map



Proposed Projects

- ~ CHIP AND CRACK SEALING PROJECTS
- ~ CRACK SEALING PROJECTS
- ~ NONSTRUCTURAL OVERLAY PROJECTS
- ~ RECONSTRUCTION PROJECTS
- ~ WATER FEATURE

0 500 1,000 2,000 Feet
 1 inch = 500 feet Date: 3/20/2024



Appendix D: PASER Manual

Pavement Surface Evaluation and Rating

PASER Asphalt Roads Manual

RATING
10



RATING
7



RATING
4



RATING
1



Contents

Introduction	2
Asphalt pavement distress	3
Evaluation	4
Surface defects	4
Surface deformation	5
Cracking	7
Patches and potholes	12
Rating pavement surface condition	14
Rating system	15
Rating 10 & 9 – Excellent	16
Rating 8 – Very Good	17
Rating 7 – Good	18
Rating 6 – Good	19
Rating 5 – Fair	20
Rating 4 – Fair	21
Rating 3 – Poor	22
Rating 2 – Very Poor	23
Rating 1 – Failed	25
Practical advice on rating roads	26

This manual is intended to assist local officials in understanding and rating the surface condition of asphalt pavement. It describes types of defects and provides a simple system to visually rate pavement condition. The rating procedure can be used as condition data for the Wisconsin DOT local road inventory and as part of a computerized pavement management system like PASERWARE.

The PASER system described here and in other T.I.C. publications is based in part on a roadway management system originally developed by Phil Scherer, transportation planner, Northwest Wisconsin Regional Planning Commission.

Produced by the T.I.C. with support from the Federal Highway Administration, the Wisconsin Department of Transportation, and the University of Wisconsin-Extension. The T.I.C., part of the nationwide Local Technical Assistance Program (LTAP), is a Center of the College of Engineering, Department of Engineering Professional Development, University of Wisconsin–Madison.

Copyright © 1987, 1989, 2002
Wisconsin Transportation Information Center

432 North Lake Street
Madison, WI 53706

phone 800/442-4615

fax 608/263-3160

e-mail tic@epd.engr.wisc.edu

URL <http://tic.engr.wisc.edu>



Printed on recycled paper.

Pavement Surface Evaluation and Rating

PASER Manual

Asphalt Roads

Donald Walker, T.I.C. Director, *author*
Lynn Entine, Entine & Associates, *editor*
Susan Kummer, Artifax, *designer*

Pavement Surface Evaluation and Rating

Asphalt PASER Manual

A local highway agency's major goal is to use public funds to provide a comfortable, safe and economical road surface—no simple task. It requires balancing priorities and making difficult decisions in order to manage pavements. Local rural and small city pavements are often managed informally, based on the staff's judgment and experience. While this process is both important and functional, using a slightly more formalized technique can make it easier to manage pavements effectively.

Experience has shown that there are three especially useful steps in managing local roads:

1. Inventory all local roads and streets.
2. Periodically evaluate the condition of all pavements.
3. Use the condition evaluations to set priorities for projects and select alternative treatments.

A comprehensive pavement management system involves collecting data and assessing several road characteristics: roughness (ride), surface distress (condition), surface skid characteristics, and structure (pavement strength and deflection). Planners can combine this condition data with economic analysis to develop short-range and long-range plans for a variety of budget levels. However, many local agencies lack the resources for such a full-scale system.

Since surface condition is the most vital element in any pavement management system, local agencies can use the simplified rating system presented in this *Asphalt PASER Manual* to evaluate their roads. The PASER ratings combined with other inventory data (width, length, shoulder, pavement type, etc.) from the WisDOT local roads inventory (WISLR) can be very helpful in planning future budgets and priorities.

WISLR inventory information and PASER ratings can be used in a computerized pavement management system, PASERWARE, developed by the T.I.C and WisDOT. Local officials can use PASERWARE to evaluate whether their annual road budgets are adequate to maintain or improve current road conditions and to select the most cost-effective strategies and priorities for annual projects.

PASER Manuals for gravel, concrete, and other road surfaces, with compatible rating systems are also available (page 29). Together they make a comprehensive condition rating method for all road types. PASER ratings are accepted for WISLR condition data.

Asphalt pavement distress

PASER uses visual inspection to evaluate pavement surface conditions. The key to a useful evaluation is identifying different types of pavement distress and linking them to a cause. Understanding the cause for current conditions is extremely important in selecting an appropriate maintenance or rehabilitation technique.

There are four major categories of common asphalt pavement surface distress:

Surface defects

Raveling, flushing, polishing.

Surface deformation

Rutting, distortion—rippling and shoving, settling, frost heave.

Cracks

Transverse, reflection, slippage, longitudinal, block, and alligator cracks.

Patches and potholes

Deterioration has two general causes: environmental due to weathering and aging, and structural caused by repeated traffic loadings.

Obviously, most pavement deterioration results from both environmental and structural causes. However, it is important to try to distinguish between the two in order to select the most effective rehabilitation techniques.

The rate at which pavement deteriorates depends on its environment, traffic loading conditions, original construction quality, and interim maintenance procedures. Poor quality materials or poor construction procedures can significantly reduce the life of a pavement. As a result, two pavements constructed at the same time may have significantly different lives, or certain portions of a pavement may deteriorate more rapidly than others. On the other hand, timely and effective maintenance can extend a pavement's life. Crack sealing and seal coating can reduce the effect of moisture in aging of asphalt pavement.

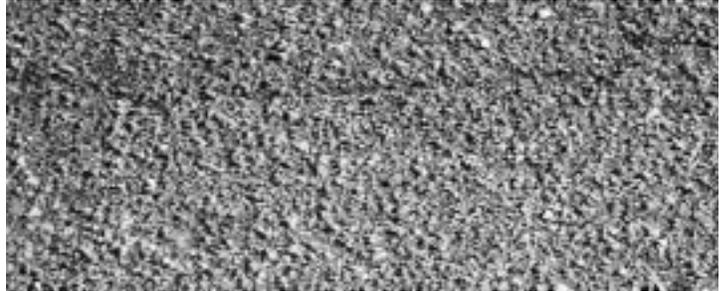
With all of these variables, it is easy to see why pavements deteriorate at various rates and why we find them in various stages of disrepair. Recognizing defects and understanding their causes helps us rate pavement condition and select cost-effective repairs. The pavement defects shown on the following pages provide a background for this process.

Periodic inspection is necessary to provide current and useful evaluation data. It is recommended that PASER ratings be updated every two years, and an annual update is even better.

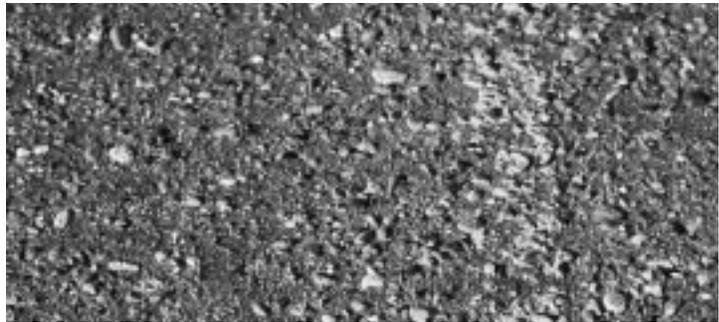
SURFACE DEFECTS

Raveling

Raveling is progressive loss of pavement material from the surface downward, caused by: stripping of the bituminous film from the aggregate, asphalt hardening due to aging, poor compaction especially in cold weather construction, or insufficient asphalt content. Slight to moderate raveling has loss of fines. Severe raveling has loss of coarse aggregate. Raveling in the wheelpaths can be accelerated by traffic. Protect pavement surfaces from the environment with a sealcoat or a thin overlay if additional strength is required.



◀ Slight raveling. Small aggregate particles have worn away exposing tops of large aggregate.



◀ Moderate to severe raveling. Erosion further exposes large aggregate.

Flushing

Flushing is excess asphalt on the surface caused by a poor initial asphalt mix design or by paving or sealcoating over a flushed surface. Repair by blotting with sand or by overlaying with properly designed asphalt mix.



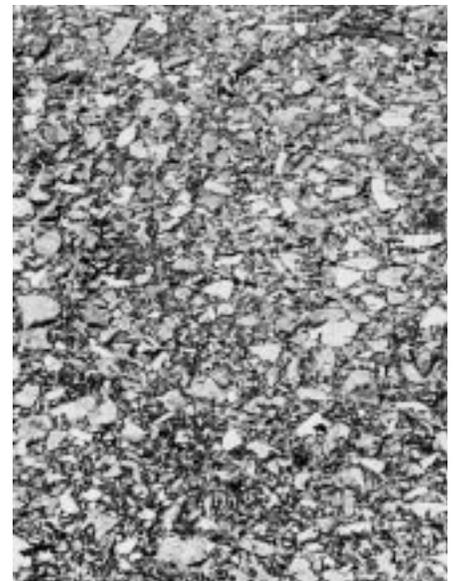
◀ Severe raveling and loss of surface material.

Polishing

Polishing is a smooth slippery surface caused by traffic wearing off sharp edges of aggregates. Repair with sealcoat or thin bituminous overlay using skid-resistant aggregate.

Polished, worn aggregate needs repair. ▼

▶ Flushing. Dark patches show where asphalt has worked to surface.



SURFACE DEFORMATION

Rutting

Rutting is displacement of material, creating channels in wheelpaths. It is caused by traffic compaction or displacement of unstable material. Severe rutting (over 2") may be caused by base or subgrade consolidation. Repair minor rutting with overlays. Severe rutting requires milling the old surface or reconstructing the roadbed before resurfacing.

◀ Even slight rutting is evident after a rain.



◀ Severe rutting over 2" caused by poor mix design.



◀ Severe rutting caused by poor base or subgrade.

Distortion

Shoving or rippling is surfacing material displaced crossways to the direction of traffic. It can develop into washboarding when the asphalt mixture is unstable because of poor quality aggregate or improper mix design. Repair by milling smooth and overlaying with stable asphalt mix.

Other pavement distortions may be caused by settling, frost heave, etc. Patching may provide temporary repair. Permanent correction usually involves removal of unsuitable subgrade material and reconstruction.

▼ Heavy traffic has shoved pavement into washboard ripples and bumps.



► Severe settling from utility trench.



► Frost heave damage from spring break-up.

▼ Widely spaced, well-sealed cracks.



CRACKS

Transverse cracks

A crack at approximately right angles to the center line is a transverse crack. They are often regularly spaced. The cause is movement due to temperature changes and hardening of the asphalt with aging.

Transverse cracks will initially be widely spaced (over 50'). Additional cracking will occur with aging until they are closely spaced (within several feet). These usually begin as hairline or very narrow cracks; with aging they widen. If not properly sealed and maintained, secondary or multiple cracks develop parallel to the initial crack. The crack edges can further deteriorate by raveling and eroding the adjacent pavement.

Prevent water intrusion and damage by sealing cracks which are more than 1/4" wide.

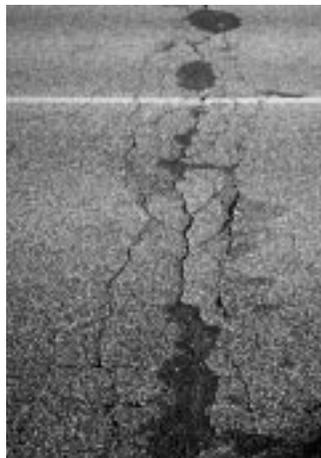
◀ Sealed cracks, a few feet apart.



▲ Tight cracks less than 1/4" in width.



▲ Open crack – 1/2" or more in width.



▲ Water enters unsealed cracks softening pavement and causing secondary cracks.



▲ Pavement ravel and erodes along open cracks causing deterioration.

Reflection cracks

Cracks in overlays reflect the crack pattern in the pavement underneath. They are difficult to prevent and correct. Thick overlays or reconstruction is usually required.

►
Concrete joints reflected through bituminous overlay.



Slippage cracks

Crescent or rounded cracks in the direction of traffic, caused by slippage between an overlay and an underlying pavement. Slippage is most likely to occur at intersections where traffic is stopping and starting. Repair by removing the top surface and resurfacing using a tack coat.

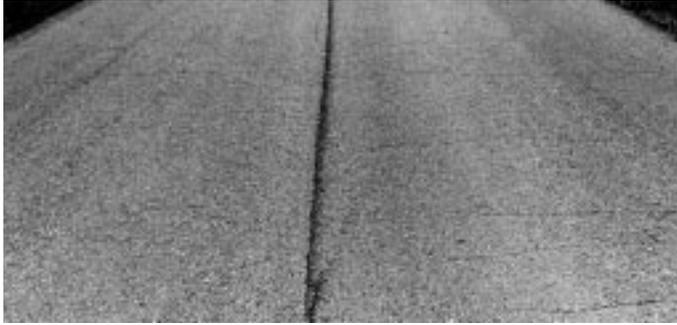
►
Crescent-shaped cracks characteristic of slippage.



►
Loss of bond between pavement layers allows traffic to break loose pieces of surface.



Centerline crack (still tight). ▶



Edge cracking from weakened subbase and traffic loads. ▼



Longitudinal cracks

Cracks running in the direction of traffic are longitudinal cracks. Center line or lane cracks are caused by inadequate bonding during construction or reflect cracks in underlying pavement. Longitudinal cracks in the wheel path indicate fatigue failure from heavy vehicle loads. Cracks within one foot of the edge are caused by insufficient shoulder support, poor drainage, or frost action. Cracks usually start as hairline or vary narrow and widen and erode with age. Without crack filling, they can ravel, develop multiple cracks, and become wide enough to require patching.

Filling and sealing cracks will reduce moisture penetration and prevent further subgrade weakening. Multiple longitudinal cracks in the wheel path or pavement edge indicate a need for strengthening with an overlay or reconstruction.

▶
First stage of wheelpath cracking caused by heavy traffic loads.



Load-related cracks in wheel path plus centerline cracking. ▼



Multiple open cracks at center line, wheelpaths and lane center. ▼



Block cracks

Block cracking is interconnected cracks forming large blocks. Cracks usually intersect at nearly right angles. Blocks may range from one foot to approximately 10' or more across. The closer spacing indicates more advanced aging caused by shrinking and hardening of the asphalt over time. Repair with sealcoating during early stages to reduce weathering of the asphalt. Overlay or reconstruction required in the advanced stages.

▶
Large blocks, approximately 10' across.



▶
Intermediate-size block cracking, 1'-5' across with open cracks.



▲ **Extensive block cracking in an irregular pattern.**

▶
Severe block cracking – 1' or smaller blocks. Tight cracks with no raveling.



Alligator cracks

Interconnected cracks forming small pieces ranging in size from about 1" to 6". This is caused by failure of the surfacing due to traffic loading (fatigue) and very often also due to inadequate base or subgrade support. Repair by excavating localized areas and replacing base and surface. Large areas require reconstruction. Improvements in drainage may often be required.

◀
Alligator crack pattern. Tight cracks and one patch.

◀
Characteristic "chicken wire" crack pattern shows smaller pavement pieces and patching.

◀
Open raveled alligator cracking with settlement along lane edge most likely due to very soft subgrade.



PATCHES AND POTHOLES

Patches

Original surface repaired with new asphalt patch material. This indicates a pavement defect or utility excavation which has been repaired. Patches with cracking, settlement or distortions indicate underlying causes still remain. Recycling or reconstruction are required when extensive patching shows distress.

►
Typical repair of utility excavation. Patch in fair to good condition.



►
Edge wedging. Pavement edges strengthened with wedges of asphalt. Patch is in very good condition.



►
Extensive patching in very poor condition.



Potholes

Holes and loss of pavement material caused by traffic loading, fatigue and inadequate strength. Often combined with poor drainage. Repair by excavating or rebuilding localized potholes. Reconstruction required for extensive defects.



Small pothole where top course has broken away.



Multiple potholes show pavement failure, probably due to poor subgrade soils, frost heave, and bad drainage.



Large, isolated pothole, extends through base. Note adjacent alligator cracks which commonly deteriorate into potholes.



Rating pavement surface condition

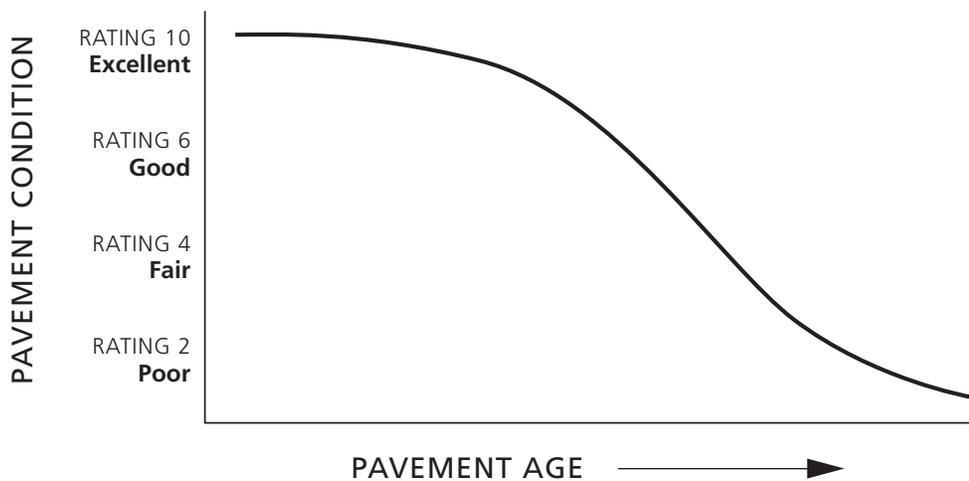
With an understanding of surface distress, you can evaluate and rate asphalt pavement surfaces. The rating scale ranges from **10–excellent** condition to **1–failed**. Most pavements will deteriorate through the phases listed in the rating scale. The time it takes to go from excellent condition (10) to complete failure (1) depends largely on the quality of the original construction and the amount of heavy traffic loading.

Once significant deterioration begins, it is common to see pavement decline rapidly. This is usually due to a combination of loading and the effects of additional moisture. As a pavement ages and additional cracking develops, more moisture can enter the pavement and accelerate the rate of deterioration.

Look at the photographs in this section to become familiar with the descriptions of the individual rating categories. To evaluate an individual pavement segment, first determine its general condition. Is it relatively new,

toward the top end of the scale? In very poor condition and at the bottom of the scale? Or somewhere in between? Next, think generally about the appropriate maintenance method. Use the rating categories outlined below.

Finally, review the individual pavement distress and select the appropriate surface rating. Individual pavements will **not** have all of the types of distress listed for any particular rating. They may have only one or two types.



In addition to indicating the surface condition of a road, a given rating also includes a recommendation for needed maintenance or repair. This feature of the rating system facilitates its use and enhances its value as a tool in ongoing road maintenance.

RATINGS ARE RELATED TO NEEDED MAINTENANCE OR REPAIR

Rating 9 & 10	No maintenance required
Rating 8	Little or no maintenance
Rating 7	Routine maintenance, cracksealing and minor patching
Rating 5 & 6	Preservative treatments (sealcoating)
Rating 3 & 4	Structural improvement and leveling (overlay or recycling)
Rating 1 & 2	Reconstruction

Rating system

Surface rating	Visible distress*	General condition/ treatment measures
10 Excellent	None.	New construction.
9 Excellent	None.	Recent overlay. Like new.
8 Very Good	No longitudinal cracks except reflection of paving joints. Occasional transverse cracks, widely spaced (40' or greater). All cracks sealed or tight (open less than 1/4").	Recent sealcoat or new cold mix. Little or no maintenance required.
7 Good	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks (open 1/4") due to reflection or paving joints. Transverse cracks (open 1/4") spaced 10' or more apart, little or slight crack raveling. No patching or very few patches in excellent condition.	First signs of aging. Maintain with routine crack filling.
6 Good	Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open 1/4"–1/2"), some spaced less than 10'. First sign of block cracking. Slight to moderate flushing or polishing. Occasional patching in good condition.	Shows signs of aging. Sound structural condition. Could extend life with sealcoat.
5 Fair	Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transverse cracks (open 1/2") show first signs of slight raveling and secondary cracks. First signs of longitudinal cracks near pavement edge. Block cracking up to 50% of surface. Extensive to severe flushing or polishing. Some patching or edge wedging in good condition.	Surface aging. Sound structural condition. Needs sealcoat or thin non-structural overlay (less than 2")
4 Fair	Severe surface raveling. Multiple longitudinal and transverse cracking with slight raveling. Longitudinal cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (1/2" deep or less).	Significant aging and first signs of need for strengthening. Would benefit from a structural overlay (2" or more).
3 Poor	Closely spaced longitudinal and transverse cracks often showing raveling and crack erosion. Severe block cracking. Some alligator cracking (less than 25% of surface). Patches in fair to poor condition. Moderate rutting or distortion (1" or 2" deep). Occasional potholes.	Needs patching and repair prior to major overlay. Milling and removal of deterioration extends the life of overlay.
2 Very Poor	Alligator cracking (over 25% of surface). Severe distortions (over 2" deep) Extensive patching in poor condition. Potholes.	Severe deterioration. Needs reconstruction with extensive base repair. Pulverization of old pavement is effective.
1 Failed	Severe distress with extensive loss of surface integrity.	Failed. Needs total reconstruction.

* Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.

RATING 10 & 9

**EXCELLENT —
No maintenance required**

Newly constructed or recently overlaid roads are in excellent condition and require no maintenance.



▶
RATING 10
New construction.



▶
RATING 9
Recent overlay,
rural.



▶
RATING 9
Recent overlay,
urban.



RATING 8

**VERY GOOD —
Little or no maintenance required**

This category includes roads which have been recently sealcoated or overlaid with new cold mix. It also includes recently constructed or overlaid roads which may show longitudinal or transverse cracks. All cracks are tight or sealed.

◀
**Recent
chip seal.**



◀
**Recent
slurry seal.**

▼ **Widely spaced,
sealed cracks.**



▲ **New cold mix surface.**



RATING 7

GOOD —

Routine sealing recommended

Roads show first signs of aging, and they may have very slight raveling. Any longitudinal cracks are along paving joint. Transverse cracks may be approximately 10' or more apart. All cracks are 1/4" or less, with little or no crack erosion. Few if any patches, all in very good condition. Maintain a crack sealing program.

► **Tight and sealed transverse and longitudinal cracks. Maintain crack sealing program.**



► **Tight and sealed transverse and longitudinal cracks.**



► **Transverse cracks about 10' or more apart. Maintain crack sealing program.**





RATING 6

GOOD —
Consider preservative treatment

Roads are in sound structural condition but show definite signs of aging. Seal-coating could extend their useful life. There may be slight surface raveling. Transverse cracks can be frequent, less than 10' apart. Cracks may be 1/4–1/2" and sealed or open. Pavement is generally sound adjacent to cracks. First signs of block cracking may be evident. May have slight or moderate bleeding or polishing. Patches are in good condition.

◀ **Slight surface raveling with tight cracks, less than 10' apart.**

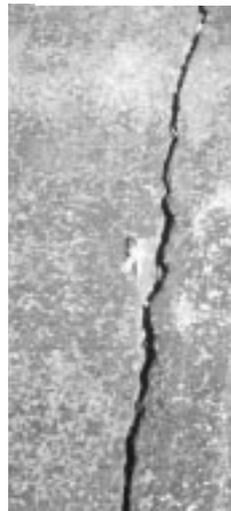
◀ **Transverse cracking less than 10' apart; cracks well-sealed.**



▼ **Large blocks, early signs of raveling and block cracking.**

▼ **Open crack, 1/2" wide; adjoining pavement sound.**

▼ **Moderate flushing.**



RATING 5

FAIR —

Preservative maintenance treatment required

Roads are still in good structural condition but clearly need sealcoating or overlay. They may have moderate to severe surface raveling with significant loss of aggregate. First signs of longitudinal cracks near the edge. First signs of raveling along cracks. Block cracking up to 50% of surface. Extensive to severe flushing or polishing. Any patches or edge wedges are in good condition.

▼ Block cracking with open cracks.



► Moderate to severe raveling in wheel paths.



▼ Severe flushing.



▲ Wedges and patches extensive but in good condition.

Severe raveling with
▼ extreme loss of aggregate.



Load cracking and slight
▼ rutting in wheel path.



RATING 4

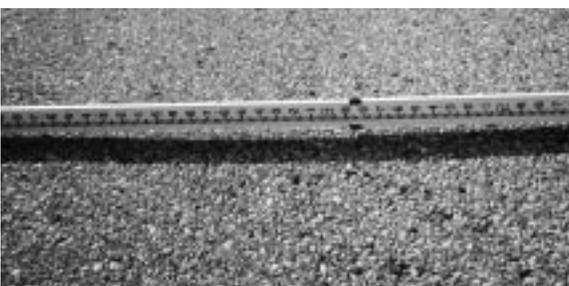
FAIR —
Structural improvement required

Roads show first signs of needing strengthening by overlay. They have very severe surface raveling which should no longer be sealed. First longitudinal cracking in wheel path. Many transverse cracks and some may be raveling slightly. Over 50% of the surface may have block cracking. Patches are in fair condition. They may have rutting less than 1/2" deep or slight distortion.



◀ **Longitudinal cracking; early load-related distress in wheel path. Strengthening needed.**

▼ **Slight rutting; patch in good condition.**



▼ **Extensive block cracking. Blocks tight and sound.**
◀ **Slight rutting in wheel path.**

RATING 3

POOR—

Structural improvement required

Roads must be strengthened with a structural overlay (2" or more). Will benefit from milling and very likely will require pavement patching and repair beforehand. Cracking will likely be extensive. Raveling and erosion in cracks may be common. Surface may have severe block cracking and show first signs of alligator cracking. Patches are in fair to poor condition. There is moderate distortion or rutting (1-2") and occasional potholes.

►
Many wide and raveled cracks indicate need for milling and overlay.



►
2" ruts need mill and overlay.



►
Open and raveled block cracks.



**RATING 3**

POOR — (continued)

Structural improvement required

◀ **Alligator cracking.**
Edge needs repair
and drainage needs
improvement prior
to rehabilitation.

▼ **Distortion with patches**
in poor condition. Repair
and overlay.



RATING 2

**VERY POOR—
Reconstruction required**

Roads are severely deteriorated and need reconstruction. Surface pulverization and additional base may be cost-effective. These roads have more than 25% alligator cracking, severe distortion or rutting, as well as potholes or extensive patches in poor condition.



►
Extensive alligator cracking. Pulverize and rebuild.



▲ **Severe rutting. Strengthen base and reconstruct.**

▲ **Patches in poor condition, wheelpath rutting. Pulverize, strengthen and reconstruct.**



►
Severe frost damage. Reconstruct.



RATING 1

**FAILED —
Reconstruction required**

Roads have failed, showing severe distress and extensive loss of surface integrity.

◀
Potholes from frost damage. Reconstruct.



◀
Potholes and severe alligator cracking. Failed pavement. Reconstruct.



◀
Extensive loss of surface. Rebuild.

Practical advice on rating roads

Inventory and field inspection

Most agencies routinely observe roadway conditions as a part of their normal work and travel. However, an actual inspection means looking at the entire roadway system as a whole and preparing a written summary of conditions. This inspection has many benefits over casual observations. It can be helpful to compare segments, and ratings decisions are likely to be more consistent because the roadway system is considered as a whole within a relatively short time.

An inspection also encourages a review of specific conditions important in roadway maintenance, such as drainage, adequate strength, and safety.

A simple written inventory is useful in making decisions where other people are involved. You do not have to trust your memory, and you can usually answer questions in more detail. Having a written record and objective information also improves your credibility with the public.

Finally, a written inventory is very useful in documenting changing roadway conditions. Without records over several years it is impossible to know if road conditions are improving, holding their own, or declining.

Annual budgets and long range planning are best done when based on actual needs as documented with a written inventory.

The Wisconsin DOT local road inventory (WISLR) is a valuable resource for managing your local roads. Adding PASER surface condition ratings is an important improvement.

Averaging and comparing sections

For evaluation, divide the local road system into individual segments which are similar in construction and condition. Rural segments may vary from

1/2 mile to a mile long, while sections in urban areas will likely be 1-4 blocks long or more. If you are starting with the WISLR Inventory, the segments have already been established. You may want to review them for consistent road conditions.

Obviously, no roadway segment is entirely consistent. Also, surfaces in one section will not have all of the types of distress listed for any particular rating. They may have only one or two types. Therefore, some averaging is necessary.

The objective is to rate the condition that represents the majority of the roadway. Small or isolated conditions should not influence the rating. It is useful to note these special conditions on the inventory form so this information can be used in planning specific improvement projects. For example, some spot repairs may be required.

Occasionally surface conditions vary significantly within a segment. For example, short sections of good condition may be followed by sections of poor surface conditions. In these cases, it is best to rate the segment according to the worst conditions and note the variation on the form.

The overall purpose of condition rating is to be able to compare each

segment relative to all the other segments in your roadway system. On completion you should be able to look at any two pavement segments and find that the better surface has a higher rating.

Within a given rating, say 6, not all pavements will be exactly the same. However, they should all be considered to be in better condition than those with lower ratings, say 5. Sometimes it is helpful in rating a difficult segment to compare it to other previously rated segments. For example, if it is better than one you rated 5 and worse than a typical 7, then a rating of 6 is appropriate. Having all pavement segments rated in the proper relative order is most important and useful.

Assessing drainage conditions

Moisture and poor pavement drainage are significant factors in pavement deterioration. Some assessment of drainage conditions during pavement rating is highly recommended. While you should review drainage in detail at the project level, at this stage simply include an overview drainage evaluation at the same time as you evaluate surface condition.



Urban drainage.
RATING:
Excellent

Good rural ditch and driveway culvert. Culvert end needs cleaning.

RATING: Good



Consider both pavement surface drainage and lateral drainage (ditches or storm sewers). Pavement should be able to quickly shed water off the surface into the lateral ditches. Ditches should be large and deep enough to drain the pavement and remove the surface water efficiently into adjacent waterways.

Look at the roadway crown and check for low surface areas that permit ponding. Paved surfaces should have approximately a 2% cross slope or crown across the roadway. This will provide approximately 3" of fall on a 12' traffic lane. Shoulders should have a greater slope to improve surface drainage.

A pavement's ability to carry heavy traffic loads depends on both the pavement materials (asphalt surfacing and granular base) and the strength of the underlying soils. Most soils lose strength when they are very wet. Therefore, it is important to provide drainage to the top layer of the subgrade supporting the pavement structure.

In rural areas, drainage is provided most economically by open ditches that allow soil moisture to drain laterally. As a rule of thumb, the bottom of the ditch ought to be at least one foot below the base course of the pavement in order to drain the soils. This means that minimum ditch depth should be about 2' below the center of the pavement. Deeper ditches, of course, are required to accommodate roadway culverts and maintain the flow line to adjacent drainage channels or streams.

You should also check culverts and storm drain systems. Storm drainage systems that are silted in, have a large accumulation of debris, or are in poor structural condition will also degrade pavement performance.

The T.I.C. publication, *Drainage Manual: Local Road Assessment and Improvement*, describes the elements of drainage systems, depicts them in detailed photographs, and explains how to rate their condition. Copies are available from the Transportation Information Center.

High shoulder and no ditch lead to pavement damage. Needs major ditch improvement for a short distance.

RATING: Fair



No drainage leads to failed pavement.

RATING: Poor



Planning annual maintenance and repair budgets

We have found that relating a normal maintenance or rehabilitation procedure to the surface rating scheme helps local officials use the rating system. However, an individual surface rating should not automatically dictate the final maintenance or rehabilitation technique.

You should consider future traffic projections, original construction, and

pavement strength since these may dictate a more comprehensive rehabilitation than the rating suggests. On the other hand, it may be appropriate under special conditions to do nothing and let the pavement fully deteriorate, then rebuild when funds are available.

Summary

Using local road funds most efficiently requires good planning and accurate identification of appropriate rehabili-

tation projects. Assessing roadway conditions is an essential first step in this process. This asphalt pavement surface condition rating procedure has proved effective in improving decision making and using highway funds more efficiently. It can be used directly by local officials and staff. It may be combined with additional testing and data collection in a more comprehensive pavement management system.

**Transportation
Information
Center
Publications**

Pavement Surface Evaluation and Rating (PASER) Manuals

Asphalt PASER Manual, 2002, 28 pp.

Brick and Block PASER Manual, 2001, 8 pp.

Concrete PASER Manual, 2002, 28 pp.

Gravel PASER Manual, 2002, 20 pp.

Sealcoat PASER Manual, 2000, 16 pp.

Unimproved Roads PASER Manual, 2001, 12 pp.

Drainage Manual

Local Road Assessment and Improvement, 2000, 16 pp.

SAFER Manual

Safety Evaluation for Roadways, 1996, 40 pp.

Flagger's Handbook (pocket-sized guide), 1998, 22 pp.

Work Zone Safety, Guidelines for Construction, Maintenance, and Utility Operations, (pocket-sized guide), 1999, 55 pp.

Wisconsin Transportation Bulletins

- #1 Understanding and Using Asphalt
- #2 How Vehicle Loads Affect Pavement Performance
- #3 LCC—Life Cycle Cost Analysis
- #4 Road Drainage
- #5 Gravel Roads
- #6 Using Salt and Sand for Winter Road Maintenance
- #7 Signing for Local Roads
- #8 Using Weight Limits to Protect Local Roads
- #9 Pavement Markings
- #10 Seal Coating and Other Asphalt Surface Treatments
- #11 Compaction Improves Pavement Performance
- #12 Roadway Safety and Guardrail
- #13 Dust Control on Unpaved Roads
- #14 Mailbox Safety
- #15 Culverts-Proper Use and Installation
- #16 Geotextiles in Road Construction/Maintenance and Erosion Control
- #17 Managing Utility Cuts
- #18 Roadway Management and Tort Liability in Wisconsin
- #19 The Basics of a Good Road
- #20 Using Recovered Materials in Highway Construction
- #21 Setting Speed Limits on Local Roads

PASER

 **Transportation
Information Center**
University of Wisconsin–Madison

Asphalt Roads